

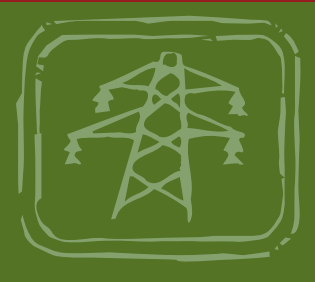
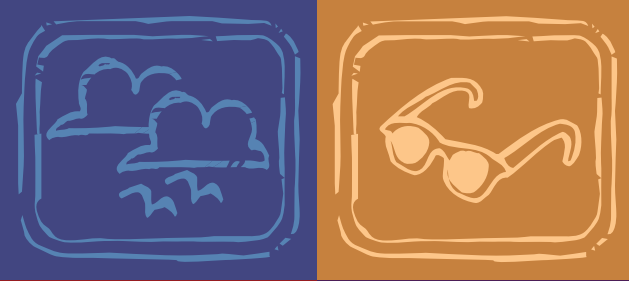


## Teacher's Handbook



THE REGIONAL ENVIRONMENTAL CENTER  
for Central and Eastern Europe

**TOYOTA**



The Teachers' Handbook was developed by the Regional Environmental Center for Central and Eastern Europe in cooperation with a number of Bulgarian, Hungarian and Polish educators and environmentalists. It is a part of the environmental educational "Green Pack," the development of which was supported by the Toyota Environmental Activities Grant Program and the Toyota Social Contributions Fund.

Circulation of and access to the Green Pack is free of charge.

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- *Environment and Development Kit – the Global Perspective*, Visual inform, A.S., Oslo, Norway.
- *State of the World*, Lester Brown, World Watch Institute Reports, 1995-2000.
- *101 Ideas for Environmental Activities*, Borrowed Nature, Bulgaria, 2000.
- *The Frog and the Ox*, Borrowed Nature and Living Earth (UK), 1999.
- *Caring for our Future*, Action for Europe's Environment, European Commission, 1999.
- *Europe's Environment: the Dobris Assessment*, European Environmental Agency, 1995.
- *Europe's Environment: the Second Assessment*, European Environmental Agency, 1998.
- *Environment in the European Union at the Turn of the Century*, European Environmental Agency, 1999.
- *Living in the Environment*, Ninth Edition, G.Tyler Miller, Jr., 1996.

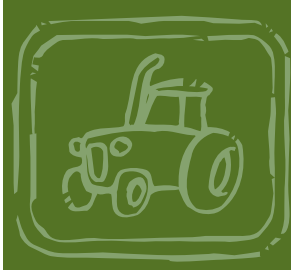
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There are three types of environmentally friendly paper used in the Green pack.

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# Foreword

■ In this era of the Internet, space travel and genetic engineering, it is easy to harbour the illusion that the world is entirely at the mercy of mankind. In a technological world, nature seems something of a decoration, trade commodity, or relic of the past. Perhaps notions such as these make it so hard to understand and appreciate that we have only a tiny grasp of the boundless world of nature. It is thanks to nature that we are alive; and it is through nature that humans have survived long enough to acquire extraordinary skills. Our highest values like love, goodness and beauty are borne out of respect for nature — a bond developed with the environment and an understanding of oneness in a world containing diverse relationships. There is no single element of human life that is completely separate and independent of nature.

Ecological education helps us restore the balance between natural and human dimensions of the environment. It enables us to learn about existing interrelations and understand their complexity. It reminds us that our bond with nature is indispensable for the world's survival and, therefore, the survival of humankind. It makes us realise that, in a world inhabited by billions of people, each one of us can make an important difference.

**Honorata Waszkiewicz**

Foundation for Ecological Education, Warsaw, Poland

■ One of today's greatest challenges is solving the problem of urban pollution. The growth of cities has led to an increasing number of people who are largely unaware of pollution's harmful effects on health and the environment.

Sixty-three percent of Hungary's schoolchildren live in some 250 urban environments. Approximately one-third of them live in Budapest. Calculations show that Hungary's biological capacity is 3.07 hectares per capita, but the rate of ecological consumption is currently at 5.01 hectares per capita.

When teaching children about environmental pollution in our cities, three major points should be covered:

- Air pollution is most harmful to human health, and its major source is automobile traffic.
- Many European cities have inadequate wastewater-treatment facilities, and there is much to be done in this respect.
- Noise levels are also a significant source of pollution, which is something that the Green Pack helps us to understand.

By using the teacher's handbook, the Green Pack goes a long way towards explaining how waste is produced, and how much of it can be reused or prevented altogether.

**Agnes Boddi Schroth**

Trefort Agoston Gyakorloiskola, Budapest, Hungary

■ Even within the relatively short span of our lifetimes, nature protection and preservation are essential human goals. This is an easier thing to understand and feel when we are anywhere from six to ten years of age, when we can feel personally the manmade harm done to our environment. As teenagers, we take on the problems concerning our individual identity: our sense of purpose, identity, or how attractive we are to ourselves and others. In fact, the older we get, the more we become entangled in the details of our own lives: our studies, our jobs, our social standing, our families, etc. And if we are not able to shape our own views and actions in such a way that we are able to show by example that we care for the environment (and are happiest when doing so), then mere words will not mean a thing to anybody.



Films and CD-ROMs allow new possibilities for communication, and they obviously have an influence on the way the world is perceived. Young people who grow up accustomed to televisions and computers sometimes expect even a book or periodical to look something like a TV programme or computer game: very little text, lots of images — maybe even some special effects. And this is not only because of limited abilities to interpret text: it is often because broadcast images are often perceived as more credible than written ones. Furthermore, television text is usually commentary on the images being broadcast — rarely vice versa. If we are to convey our most important messages, it seems we will never be completely effective if we are unable to in some way depict or illustrate what it is we wish to say.

**Jacek Schindler**

Association Eko Idea, Wroclaw, Poland

■ The notion of “sustainable development” is not easily defined. It would acquire different shades of meaning if defined by an economist, an environmentalist, a sociologist or a hydrologist. Sustainable development is a comprehensive concept, a long-term objective, a way of life — even a value system. The challenge to be as effective as possible in this process has become more of an agenda priority than the need for parallel education in the fields of environment and development.

We set out to achieve a variety of objectives through the Green Pack lessons: to instill knowledge, to develop skills for assessment and decision-making, and to develop responsible attitudes and behaviour. And we have the opportunity to do all this through an attractive and exciting way teaching children of different ages. The “green lessons” are entertaining, topical, illustrative and informative. Not only do they address a number of visible problems, they also place the teacher and students on equal footing. The lessons show that everyone has something important to learn, that everyone must take responsible decisions, and that everyone can learn more about themselves by studying the world outside.

In any case, students will not remain impartial. They will, instead, be responsible for the future.

**Tatyana Miteva**

Earth Forever Association, Svishtov, Bulgaria

■ It is very apt that the origins of support for the Green Pack have been a result of the UN’s Global Environment Award to the Toyota Motor Corporation. This reminds us that, though environmental problems are felt locally, they are a global issue. Within the “pack” we have tried to present these often complex global environmental challenges and show how they relate to Europe and its citizens. The explanation of global and European environmental information and data to teachers — and therefore their students — is a prime consideration in the Green Pack’s approach. We want to demonstrate, in a clear way, how we all “fit” into the environment and how our actions affect it. Understandable environmental information — and the knowledge given by it — is key to allowing us all to make decisions on how we run our lives and decide the priorities that our nations should follow. The Green Pack is a tool for teachers and pupils to begin that understanding. This will hopefully lead to a way that mistakes of the past can be avoided in future generations.

**Robert Atkinson**

The Regional Environmental Center for Central and Eastern Europe, Szentendre, Hungary





# Acknowledgements

■ Development of the Green Pack was made possible by the cooperation and good will of many individuals and organisations that took part in its contents.

■ We wish to thank the Bulgarian teachers: Atanaska Margaritova, Elena Usheva, Maria Pirgova and Tatyana Miteva; the Hungarian teachers: Agnes Boddi Schroth, Andras Keri, Gyorgy Bertalan and Judit Heszlenyi Szaszne; and the Polish teachers and educators: Anna Gajer, Anna Schindler, Anna Talik, Barbara Kekusz, Honorata Waszkiewicz, Izabela Majstruk, Jacek Schindler, Jerzy Sadowski, Jozefa Magdalena Ciszowska, Justyna Jedrzejewska, Malgorzata Cydeyko, Malgorzata Podkanska, Mirosława Sliwka and Urszula Osmolska-Jung, for their valuable contributions to the lesson scenarios.

■ We wish to thank the three artists Laszlo Falvay (Hungary), Nelly Marinova (Bulgaria) and Stoyan Nikolov (Bulgaria), whose illustrations assisted us in visualising our concerns and messages to future users of the Green Pack.

■ We wish to express our warmest gratitude to a number of organisations and institutions that provided us with various educational and documentary films:

- Television Trust for Environment (TVE-International) — for the valuable educational films Eden Shorts and the video-clips used in the video cassette and CD-ROM;
- Eko Idea Association, Wroclaw (Poland) — for the challenging educational series of films, More or Better;
- the Borrowed Nature Association (Bulgaria) — for their excellent video-impressions and the film Look Up;
- the Resource Center, an outreach component of the Environmental and Occupational Health Sciences Institute (EOHSI) and the University of Medicine and Dentistry of New Jersey-School of Public Health (UMDNJ-SPH)—for the valuable educational films Living with Toxins, and The Town's Dilemma: Jobs or Health?; and
- the WWW Television and Film Center for their challenging film The Kingdom.

■ We extend our most sincere thanks to our donors from the Toyota Motor Corporation, Toyota Foundation and Toyota Motor Europe. Their understanding and trust in what we are doing accompanied and encouraged us throughout the months of hard work on the Green Pack.

Thank you.

# Using the Handbook

This handbook is part of the Green Pack and is intended primarily for primary school teachers and their students, but it could also be used at other levels of education. It focuses on particular aspects of environmental protection and is recommended for use in combination with the other Green Pack components of the Green Pack: the video cassette, CD-ROM and dilemma game.

The handbook is broken into five chapters:

- **Environmental components** — air, water, soil and biodiversity;
- **Threats and pressures** — urbanisation, noise, waste and chemicals;
- **Human activities** — energy, transport, industry, agriculture, forestry and tourism;
- **Global challenges** — climate change, ozone depletion, acidification; seas and oceans; and
- **Values** — ethics and values related to consumerism, human health and the environment, citizens' rights, and responsibility for the Earth's future.

Each environmental topic is covered by one or more of the lesson plans. The plans are structured to provide users with information about the major concept, relevant subjects, materials needed, time and place, objectives and methodology. The introduction provides basic information on the issue, and users are recommended to look for more information in the relevant section of the CD-ROM.

The activities form the core of the lesson plans. They have a guiding, rather than compulsory character. They are intended to kindle the teacher's imagination and lead to the organisation of events similar to the ones suggested, but meeting the particular needs and abilities of the students.

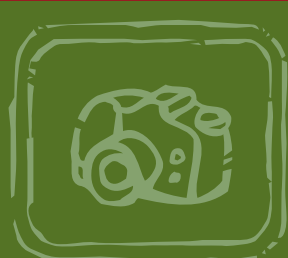
Users can find various student fact sheets and schemes at the end of each lesson to be photocopied and distributed before an activity begins.

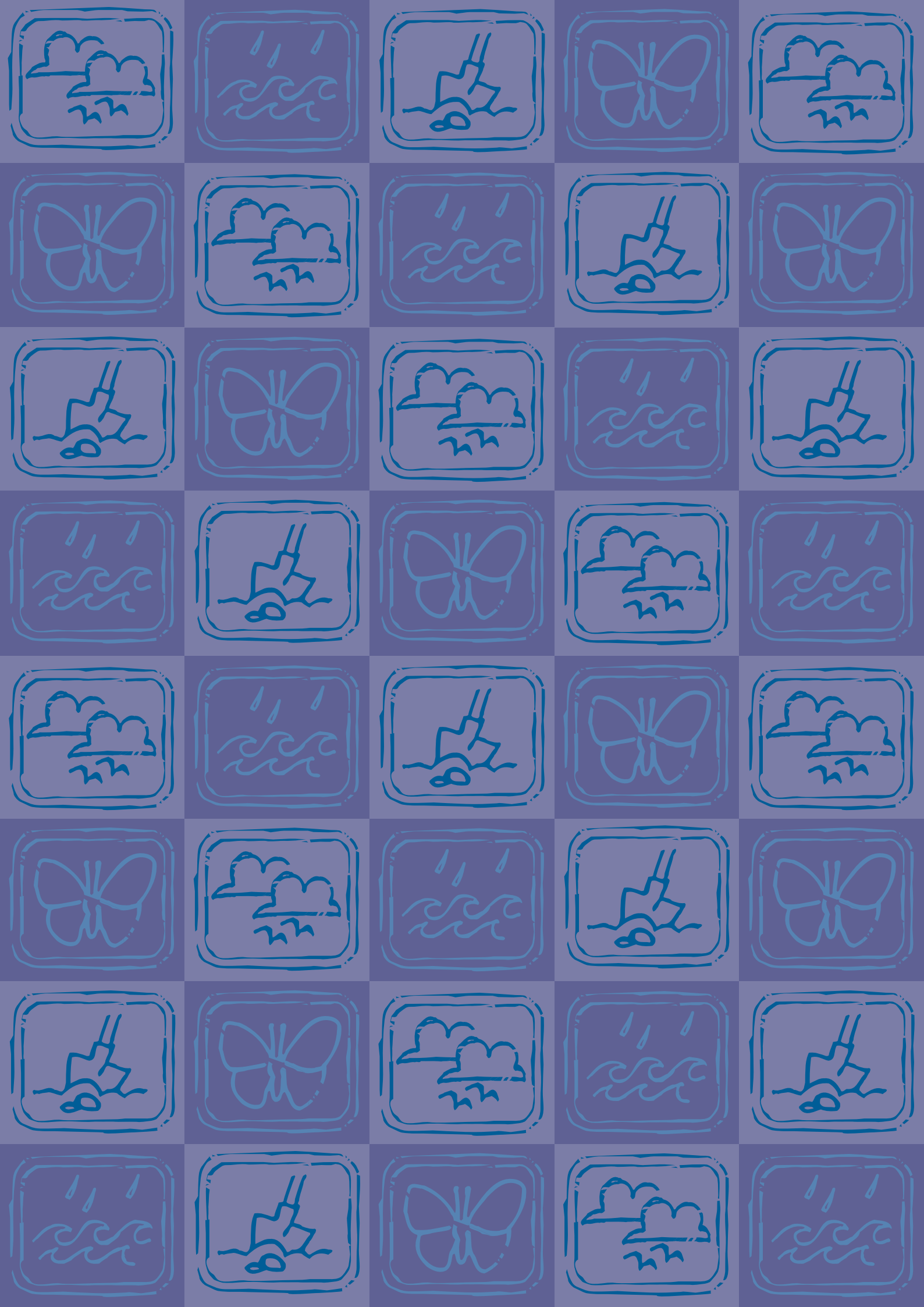
A table presenting schematic information on environmental topics, lesson plans and their compatibility with different school subjects, as well as the recommended video clips and films, is enclosed at the end of the handbook.

The handbook emphasises the formation of new values in students and the setting of a new model of behaviour at school, at home and in society, rather than the mere accumulation of knowledge in particular environmental areas. In this context, students are, above all, partners with the teachers in the accomplishment of various activities, discussions, role-plays and decision-making processes. Via the teachers and students, the main messages of the handbook are also addressed to other members of the family and society.

**Kliment Mindjov**

The Regional Environmental Center for Central and Eastern Europe







Air

Water

**Environmental  
Components**

Soil

Biodiversity





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## Air Quality

Author: Kliment Mindjov

<b>Major concept</b>	Air quality is important to human health.
<b>Duration</b>	2-3 class periods
<b>Time of year</b>	Any
<b>Place</b>	Classroom
<b>Materials</b>	Posters and the Green Pack video cassette
<b>Subjects</b>	Chemistry, biology, physics
<b>Aims</b>	To provide information on and practical ways to improve indoor and outdoor air quality
<b>Methods</b>	Lecture, discussion, brainstorming, video presentation

### Introduction

Air is a mixture of nitrogen (78%), oxygen (21%), carbon dioxide (CO<sub>2</sub>) and some inert gases. It also consists of water vapours of varying quantity. Air contains numerous harmful substances: natural pollutants such as dust and volcanic ash, and pollutants that are by-products of human activity.

People think that clean air is essential for good health. And they are absolutely right! The public's attention, however, is often focused on the importance of outdoor air quality, while indoor air quality is underestimated or forgotten.





Scientists now believe that indoor air is frequently more polluted than outdoor air, even in large industrial cities. Also, people spend more time indoors.

Clean air is of special importance for children, since they breathe a greater volume of air relative to their body than adults, putting them at a greater risk of accumulating higher concentrations of pollutants in their bodies.

## Activities

- 1 Begin by asking the pupils how long a human can survive without breathing. Ask a few volunteers to take a deep breath and hold it for 30 seconds. Let them explain the class how they feel afterwards.
- 2 Present information to the class about the gases that make up the air. Remind them that the content of the air changes during the breathing process. The share of oxygen decreases as CO<sub>2</sub> increases. Many activities change the content of the air, not just breathing. Human activities, for example, may lead to discharges of different chemical substances into the atmosphere.

Find more information in the Air chapter of the CD-ROM.

### Outdoor air pollution

- 1 Explain to the class that when the sun shines, the gases exhausted from cars such as nitrogen oxides (NO<sub>x</sub>) and volatile organic compounds combine to form ozone. Although the Earth needs ozone in the upper atmosphere, its effects at low altitude are extremely harmful. This effect is called summer smog, and more than 100 million people are affected by it in Europe alone.



Winter smog occurs when pollutants are trapped by a mass of cold air hovering over a city (especially sulphur dioxide [SO<sub>2</sub>], NO<sub>x</sub> and particles). The worst pollution tends to occur in the urban environment, where two of every three Europeans live today. Severe winter smog episodes frequently create health hazards in parts of Central and Eastern Europe, for example, in the densely populated areas of the Czech Republic, eastern Germany and Poland. Combustion processes, including residential heating, power production and industry, are its main sources.

- 2 Present to the class the Our Air section of the video cassette.
- 3 Organise a discussion on what causes smog: (*fuel combustion processes, transport, household heating, industry, energy production*). Use the additional information found in the text on Types of Air Pollution on page 14.
- 4 Show pupils the How to Keep Our Air Clean video clip. Explain that it is just one possible way to keep the air clean. Ask them to suggest more examples.
- 5 Explain that air pollution in Central and Eastern Europe is caused mainly by the burning of fossil fuels for motorised transport and energy production. To counter this pollution, national governments enact strict legislation and tighten restrictions on air pollutants. They also inform the public regularly about the strict standards and preconditions that require enterprises in the industrial and energy sectors to employ new, clean technologies.



### Indoor air pollution

- 1 Explain that many materials release hazardous gases and particles. Tobacco smoke is among the best known causes of indoor air pollution.
- 2 Brainstorming topic: "Which materials and/or activities may cause air pollution in a closed room?" (*various household cleaning products, construction materials, paints, thinners, perfumes and cosmetics, chemicals used in printing and copying devices, diverse synthetic materials, laboratory utilities and chemical reactants, drawing/painting/modelling materials, etc.*). Write the answers on the board.
- 3 Brainstorming topic: "What are the possible effects of repeated exposure to these chemicals?" (*respiratory system problems, higher sensitivity or allergic reactions, neurotoxic reactions, weakened immune system*). Write the answers on the board.
- 4 Present some less known air pollutants such as formaldehyde, radon, asbestos and electromagnetic fields. Refer to the text on Dangerous Substances on page 15.

### How to cope?

Have a brainstorming on how the health risks associated with air pollution can be reduced (*use of more natural materials at home, strict controls over air pollution and access of citizens to relevant information, regular ventilation of closed spaces*). Write the answers on the board.

### Follow-up

- Encourage the pupils to discuss what they have learned about indoor air quality with their families. Have them prepare a list of things they can do to improve this quality and reduce their health risks. Which of these actions could also be applied in the classroom? Write the best proposals on the board. Choose the best of these ideas, make a sign and hang it in the classroom.





## Types of Air Pollution



### Urban air pollution

Urban areas are growing worldwide, as are their air pollution levels. Europe, for example, is a highly urbanised continent with more than 70 percent of its inhabitants living in urban areas. Traffic, combustion and industrial production lead to airborne emissions with elevated concentrations of pollutants. This pollution gives rise to a range of problems such as health risks, accelerated deterioration of building materials, damage to historical monuments and harm to the vegetation in and around cities.

### Air pollution from transport

Smog occurrences and long-term average concentrations of harmful compounds such as lead, benzene, particulate matter and benzopyrene are significantly increased by road-transport emissions. Road transport also contributes more than half of  $\text{NO}_x$  emissions and 35 percent of volatile organic compound emissions. Diesel-engine vehicles also produce very fine particulate matter, which is extremely harmful to human health. A significant air pollution problem in Nordic countries results from the use of studded tyres in winter. These tyres wear down road surfaces and produce grit, which becomes suspended in the air.

### Air pollution from industry

Air pollution is also caused by industry. The level of impact of the emission source depends on the height of the stack and the prevailing wind direction. Primary pollutants with longer residence times include acidifying compounds (such as sulphur dioxide,  $\text{NO}_x$  and ammonia) and aerosol-bound pollutants (such as dust, heavy metals and persistent organic pollutants).

### Hot spots

“Hot spot” is a term used to describe an area with high levels of short-term pollution. Populations near pollution sources are at a high risk of exposure. Hot spot pollution occurs on urban streets with heavy traffic and in cities near industrial stacks.



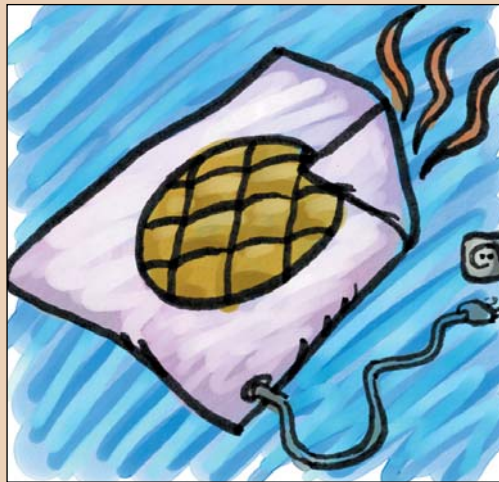
## Dangerous Substances

**Formaldehyde** is a water-soluble, colourless, toxic gas with a specific odour. It is used in many disinfectants, preservatives and agricultural chemicals, as glue in furniture panelling and as a fireproof agent in some complex materials. Traces of formaldehyde are also found in household wax, oil, shampoo, toothpaste, beer, wine, wallpaper, paint, tobacco and even car interiors. Since formaldehyde never forms a complete chemical bond, it can outgas for years, long after there is no noticeable odour. Its vapours affect mostly the respiratory system, skin and heart. One way to avoid formaldehyde impact on human health is to use zeolites — minerals that have huge absorption capacity. They absorb its vapour as well as dust, odours, smoke and other air pollutants.

**Radon** is a naturally occurring radioactive gas that is odourless, tasteless and invisible. It is a product of uranium or radium decay and can be found in groundwater or enter the home through cracks in floors and walls. Radon can cause cancer. Sealing cracks in houses and improving ventilation are two ways to combat radon.

**Asbestos** is a group of minerals that occur naturally in certain types of rock formations. Asbestos is a strong fire- and corrosion-resistant material that serves as a good heat insulator. These properties made it once considered a miracle material and insured its widespread use. However, people slowly discovered the health risks associated with breathing in asbestos fibres. Once inhaled the asbestos particles become forever trapped in the lungs and digestive system, posing serious health risks such as cancer. The effects may not be noticeable for years after exposure. Despite these effects, asbestos-containing material poses little health risk if it is properly handled, managed and maintained.

**Electromagnetic fields** are invisible fields of energy produced wherever an electric current is flowing. Electromagnetic fields are found in all living things and throughout nature. Electromagnetic pollution occurs when the field is stronger than what is considered safe. Spending a lot of time at home under such conditions — working at a computer, sitting too close to the TV or sleeping under an electric blanket — can result in undesired health effects.



There is increasing evidence that long-term exposure to electromagnetic pollution can cause cancer, leukaemia, immune disorders, miscarriages and other problems. Children are more at risk because scientists suspect that electromagnetic radiation affects the body's mechanisms that regulate cell growth.

Precaution is of great importance. There are several simple measures to minimise health risks:

- Avoid using electric blankets.
- Keep appliances such as TV sets, electric clocks and computers at least one metre from the body.
- Watch television from a distance of at least 2 metres.
- Sit at least 60 centimetres from a computer monitor.
- Use protective screens or glasses.
- Alternate work and rest regularly.



# The Atmosphere

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The atmosphere consists of four layers of air covering the Earth.

The lowest layer is called the **troposphere**. Although it is only 8-11 kilometres above the Earth, the troposphere contains 95 percent of the atmosphere's gases. It is here that pollutants mix and react with atmospheric components. The troposphere plays an extraordinarily important role in maintaining life on Earth.

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The next layer is called the **stratosphere**, and it extends to about 30-50 kilometres above the Earth. Two-thirds of its outer part consists of ozone, which plays an extremely important role in filtering the ultraviolet radiation coming from the sun. Without this layer, life on Earth could not exist. Some polluting gases rise from the troposphere to the stratosphere and destroy the ozone layer.

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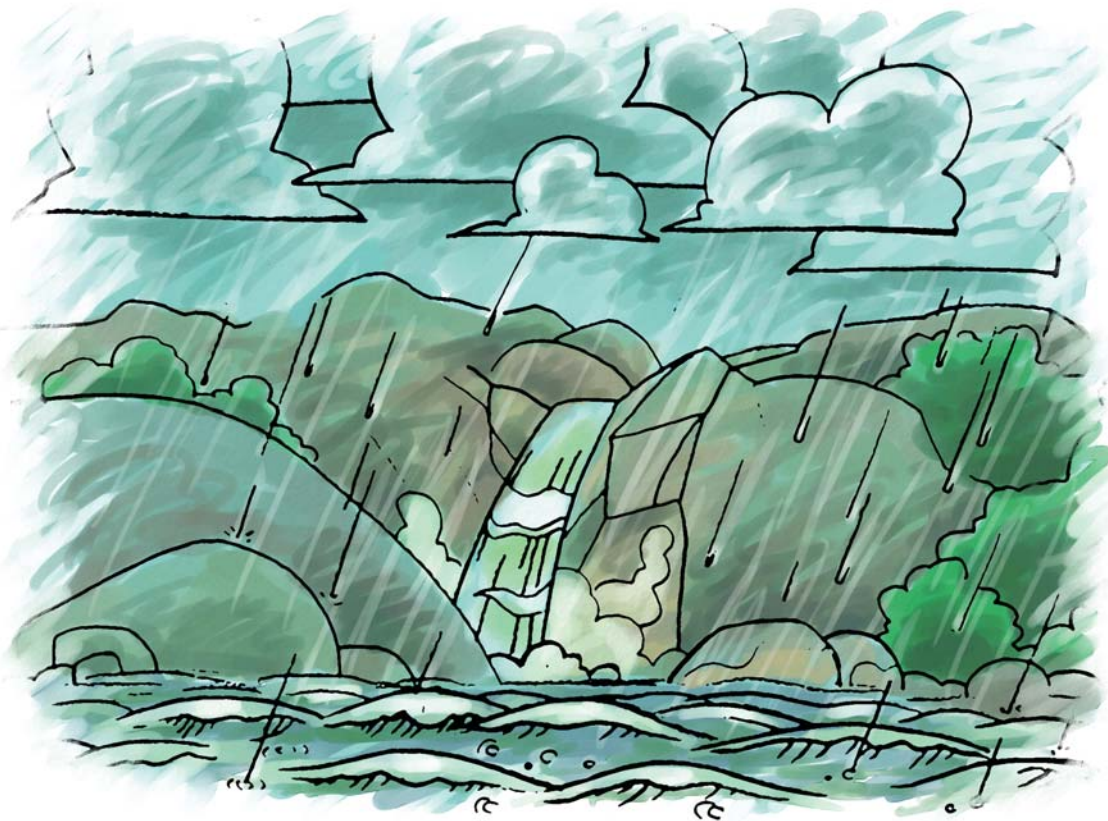
The two outer-most layers are called the **mesosphere** and the **thermosphere**.

Although the natural atmospheric processes are self-regulating, the substances and chemicals released through human activities may cause irreversible transformations in the atmosphere and lead to substantial climate change.

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## Water: The Essence of Life

Author: **Kliment Mindjov**

<b>Major concept</b>	We all use water, so each of us carries a responsibility to conserve it and protect it from contamination.
<b>Duration</b>	7 class periods (the first two activities are shorter and suitable for younger pupils)
<b>Time of year</b>	Any
<b>Place</b>	Classroom
<b>Materials</b>	Glass of potable water, small tray, sand, small quantity of powdered soft drink (or a few crystals of potassium permanganate), two 3-litre water containers (pots or glasses), funnel, 1.5-litre plastic bottle, small stones and pebbles, felt, worksheets
<b>Subjects</b>	Chemistry, biology, geography, physics, ecology, sustainable development
<b>Aims</b>	<ul style="list-style-type: none"> <li>• To explain the significance of water;</li> <li>• To show how simple changes of habits can save water;</li> <li>• To increase knowledge about water pollution, and demonstrate household methods of preventing it.</li> </ul>
<b>Methods</b>	Lecture, experiment, discussion, brainstorming

### Introduction

Water is a unique part of the Earth's surface, and water abundance is precisely the reason why our world is also called the "Blue Planet." Despite this abundance, however, the vast majority of water belongs to oceans and seas, and only 0.6 percent of the total water quantity is suitable for drinking.





Surface water and groundwater are important elements of the earth's hydrological cycle. Surface water includes rivers, lakes and glaciers. Groundwater remains one of the least-studied and most difficult water resources to determine.

Water is used in agriculture (irrigation), by industry (as a cooling and heating agent) and for domestic purposes (drinking, personal hygiene, washing, recreation, etc.). Nowadays, water waste and water pollution are quite serious problems that may bring mankind to the brink of catastrophe.

Since we all use water, we are all responsible for saving it. The two basic principles behind maintaining water resources are: conservation and protection.

## Activities

### The water cycle (for younger students)

Hold up a glass of water and invite a volunteer to take a sip and determine its age. Explain to the class that the water's age is approximately 4.5 billion years old (as old as our planet), and it is in constant motion back and forth between the ground and atmosphere. The sun and wind cause evaporation from the soil, plant leaves, animal bodies and the surfaces of rivers, lakes and oceans. In this way, liquid water is transformed into steam. Under certain conditions, the steam condenses and falls back to the ground as rain, sleet or snow. This process of water reaching streams and rivers — often carrying various other materials along with it — is called "outflow." It is in this way that rainfall feeds rivers and lakes, and rivers then flow into the oceans. Some water that falls, however, goes beneath the ground, and this creates underground (subterranean) reservoirs.

For a demonstration, please use the interactive presentation of the water cycle included on the CD-ROM.

### Seawater and freshwater (for younger students)

Distribute copies of the Seawater and Freshwater fact sheet on page 24 to the students and analyse the similarities and differences between those two types of water. Point out that, even though it covers 70 percent of the Earth's surface, seawater's salinity renders it useless for direct drinking, cooking or irrigation. Freshwater makes up only 2 percent of the globe's total water reserves and should therefore be protected from pollution.

### We can't live without water

- 1 Present the information contained in the introduction to the class, along with additional data taken from the Water chapter of the CD-ROM.
- 2 Explain to the students that the world is facing a global water crisis:
  - More than 1 billion people have no access to clean, potable water.
  - More than 2.4 billion people live in bad sanitary conditions (i.e. no sewerage network, no contemporary treatment facilities for household wastewater).
  - Forecasts show two-thirds of the Earth's population will be suffering from water shortage by 2025.
- 3 Show students the Freshwater video (included on the video cassette). After viewing, discuss the following questions with them:
  - How much water does an adult male use daily? (*approximately 80 litres daily*)
  - How many people die each day as a result of contaminated drinking water? (*approximately 25,000 — most of them children.*)
- 4 Try to answer the questions asked at the end of the educational video:
  - Why is it so important to manage water resources properly?
  - What problems are caused by contaminated water?
  - How can we protect water?
  - How can we help? (*use the information presented in the How to Save Water text.*)



## How to save water at home

Explain to the class that even some small changes in our everyday habits can save water.

### Brushing your teeth

- 1 Ask students how often they brush their teeth. Then, ask a volunteer to demonstrate his or her brushing technique. Presumably, the student will go to the sink, turn on the tap and start brushing his or her teeth while the water is running. If the student does this, the alternatives for saving water will be clear. If not, then the volunteer has provided a positive example. Note: if a sink is not handy, then the volunteer can offer a simple explanation.
- 2 Discuss whether there is another, more economical, way to brush teeth. For example, one should turn on the water only while washing the tooth-brush or rinsing the teeth, and turn off the water while brushing. How much water can be saved this way?

### Shaving

- 1 Ask a boy in the class to demonstrate how his father or brother shaves (if he himself doesn't shave yet). The student goes to the sink, turns on the water and pretends to shave. If he lets the water run throughout the whole demonstration, the point will be clear. Again, the student may simply explain the process instead.
- 2 Discuss whether there are other, more economical ways of shaving: for example, wetting the brush or washing the razor blade in a glass or bowl of water. Ask students if they have ever seen any of their older relatives shaving in this way.
- 3 Explain to the class that both of these demonstrations may not, at first glance, appear to be very effective means of saving water. However, small changes like this can have an enormous effect when practiced by everybody. In order to convince the sceptics, please distribute the How to Save Water at Home fact sheet, and invite the students to solve the mathematical problems presented there. You can organise a contest to see who is quickest to find a solution, and reward all those who answer correctly.

#### Answers:

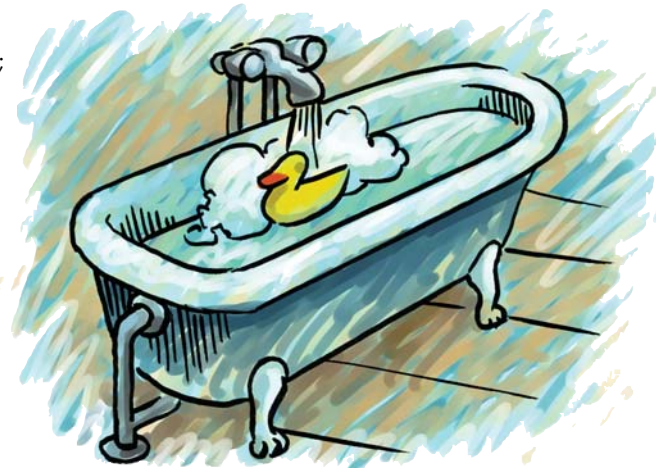
How do I brush my teeth?

A: 131,400,000 litres; B: 21,900,000 litres; C: 109,500,000 litres

How do I shave?

A: 43,800,000 litres; B: 3,650,000 litres; C: 40,150,000 litres

- 4 Give the students time to exchange comments or observations after the calculations.
- 5 Organise a brainstorming session about different ways that households can use water more economically. Discuss the tips for Conserving Water at Home on page 22. Write all suggestions on the board and then determine which of them are realistic and can be used to develop a plan for saving water at home.
- 6 Encourage the students to engage their family members in:
  - solving the mathematical problems on the fact sheet;
  - learning about ways of Conserving Water at Home from the text on page 22; and
  - drawing up a family plan to save water.





## How to protect household water from contamination

- 1 Have your students collect packaging and containers (with labels) from different household washing and cleaning detergents for a period of one to two months. Afterwards, the students can bring what they have collected to the classroom.
- 2 Organise a brainstorming session entitled “How do we pollute water at home?” (*using the toilet, by washing and cleaning throughout the house with various chemicals, etc.*)
- 3 Explain that human sewage does not actually pose a huge threat to nature. Various micro-organisms have adapted themselves to process organic human waste. In fact, the major problems are caused by the contemporary chemical substances used for household washing and cleaning. After reaching the water, they become mixed with sewage and enter the wastewater network (the septic pit or — via the sewerage system — the wastewater treatment plant). Chemicals kill the micro-organisms that decompose organic human waste; and this, in turn, destroys a carefully balanced system.



Point out that there is no washing or cleaning detergent yet in existence that is completely harmless to the environment. All such chemicals contribute pollution to varying degrees, and this is why the best we can do is to use them in a reasonable and proper way and, preferably, buying those products labelled as being safer and containing environmentally friendly substances. Another option is to put some rather forgotten cleaning tips more frequently into use. (See the text on How to Protect Water from Pollution on page 23).

- 4 Thoroughly examine the washing and cleaning-detergent packaging brought to class, and study the contents of the labels. Are there any “environment friendly” icons? Contact parents and experts for additional clarifications.
 

Point out to the class the fact that various petrol derivatives (car lubricants and fuels) are especially dangerous. Direct disposal of these products into the sewerage network is unacceptable and should be made only in specially designated places (auto services and oil stations), where their collection, transport and treatment are strictly regulated.

## Who’s polluting the water?

- 1 Organise a brainstorming on how human activity contaminates water basins (*agriculture, industry, construction, waste spills and leakage of dangerous substances accidents, non-regulated disposal of household waste, etc.*). Write all the answers on the board. Ask students to underline those which may be actual reasons for pollution of your home community’s water basins.
- 2 Explain to the class that mankind has been dumping waste underground for a long time. Many of these dumpsites can develop into “spot pollution sources” of subterranean and surface waters. Perform the following demonstration to illustrate the effect:
  - Line a plastic tray with a 2-3 centimetres of dry sand.
  - Make a small hole in the sand on one end of the tray and fill it with a small amount of powdered drink (dry, coloured juice concentrate) or, alternatively, potassium permanganate crystals. Explain that you are simulating an underground waste deposit at a dumpsite. Such a location is called a “pollution source.”
  - Lift the tray at the “waste” end and explain that water does not always travel straight down the soil.
  - In order to simulate rainfall, begin spraying the “waste-disposal point” with water.

Ask the students to observe how the sand colour is changing. What conclusions can be reached?



- 3 Point out that environmental contamination spreads in a similar manner. Polluting agents are picked up by water travelling through the soil and carried to underground water deposits, wells, rivers, lakes and other places from which we draw potable water.
- 4 Encourage the pupils to share what they have seen from this demonstration with their families and to discuss with them how to dispose of any old or useless gardening chemicals.

## Treating household wastewater

### Formation and purification

- 1 Illustrate the formation of household wastewater by mixing small quantities of different cleaning agents, detergents, coffee grounds or tea dregs, pieces of toilet tissue, water colours, etc. with about 1 litre of water poured into a 3-litre glass container.
- 2 Prepare a filter using the following method (see the drawing below): cut out the bottom of a 1.5 litre plastic bottle and use the remaining upper part. Turn it upside down to convert it into a funnel. Make a filter inside the funnel by placing consecutive layers of small rocks, stones, pebbles, felt and, finally, sand.
- 3 Place the funnel's mouth in another empty 3-litre container (as shown on the drawing). You are now ready to simulate the mechanical treatment of household wastewater by slowly pouring the contents of the first vessel into the second.
- 4 After observing the water filtration process, ask the students to answer the following questions:
  - What is the degree of purification of this water after filtering?
  - Is it possible to drink it directly after filtering?

### Discussion points

- 1 Explain that the drinking water piped into our homes via pipelines is processed beforehand by multiple-stage water treatment plants. This treatment includes sand filtering, followed by disinfection (e.g. chlorination). Afterwards, the water is ready to be supplied to consumers.
- 2 Hand out the Stages of Wastewater (Sewage) Treatment fact sheet to the students. Explain that in rural and suburban regions, household sewage water is collected into septic pits. In order to avoid contamination of subterranean waters, these pits should be discharged and cleaned regularly by specialised companies every three or four years of operation.



In larger cities, wastewater is usually supplied via the sewage network to a wastewater treatment plant. Here, the water first passes through a mechanical stage for the extraction of large, solid garbage. Then follows a second (biological) stage, where conditions for aerobic decomposition of organic waste are created using micro-organisms and oxygen. After this stage, the wastewater still contains organic compounds, suspended solid particles, phosphates, nitrates and heavy metals. This is why, in some countries, a third stage is utilised: this comprises a series of chemical and physical processes to remove any contaminants remaining in the water after the previous two stages. This water, now treated and relatively clean, is rerouted back to the basins. This method of three-stage treatment is still far from being affordable in all European countries, but the number of these plants is continuously increasing.

Stress to your students that one of the most important tasks of Central and Eastern European countries on the way to EU accession is the construction of contemporary wastewater treatment plants in all communities with a populations exceeding 10,000 inhabitants.

### 3 Study and discuss the following issues with the class:

- Where does potable water in your town come from? How is it treated?
- Are there any sewage system and wastewater treatment plants constructed in your community?
- If the water is not treated, are there any plans for eventual construction of a treatment facility?

#### Follow-up

- Organise visits to a water-purification facility and a wastewater treatment plant. Meet with municipal specialists responsible for the water supply and water-pollution prevention. Discuss with them the intentions of your family to save water and to protect it from contamination. Try to find information on issues associated with municipal plans to further improve drinking-water quality and pollution-prevention techniques. Investigate any specific pollution sources in your home region and find out which measures are being taken by local officials.
- Prepare an informational “green” wall for a highly visible location at your school. Organise a “water day” or “water week” to stress the necessity of saving and protecting water resources. Contact the local media and make your initiative known to the local community.

#### Conserving Water at Home

- Before washing up, remove the larger bits of food from dish surfaces.
- Don't wash utensils under running water, but use the sink plug to collect water into the sink instead. This will save half the amount of water used normally.
- Plug the sink when washing fruits and vegetables.
- Cooling hot objects under running water is wasteful.
- Run your washing machine only at full capacity.
- Soak extremely dirty clothes in a separate tub containing water and detergent prior to running them in a washer.
- Use soap and a bucket of water for washing the car: use a hose only for rinsing at the end.
- Wash terraces and balconies when it's raining.
- Gather leaves with a rake instead of washing them away with a hose.
- Do not water the garden with drinking water. Use a well or collected rainwater.
- Avoid watering in either heavy wind or strong sunlight: these are times when water evaporates the quickest.





## How to Protect Water from Contamination



**Dishwashing liquids and powders** Dishwashing products sold nowadays are toxic and corrosive. Vinegar, water or dissolved baking soda can be used instead.

**Window cleaners** Commercial window-cleaning products are also toxic and corrosive. Common household items such as warm water and vinegar (11:1 ratio) are safer alternatives.

**Drain cleaners** These products usually contain strong bases, with corrosive and toxic elements that may also cause burning. You can use a pump or wire to unclog a drain. For regular cleaning use a quarter-glass of vinegar and a quarter-glass of baking soda; rinsing afterward with hot water.

**Bleaching solutions** These are corrosive and toxic. Instead, you could substitute a half a glass of vinegar or baking soda.

**Oven-cleaning gels and powders** These have generally strong bases, and are toxic and corrosive. Instead, clean the oven at regular intervals with baking soda.



## How to Save Water

Scientists claim that when modern technologies are applied, household water consumption is reduced by one-third, agricultural by one-half and industrial by 90 percent! It is only necessary to:

- repair water pipes to minimise water lost in transport;
- implement the “drop” method of agricultural irrigation to increase water-use efficiency by minimising evaporation losses;
- build wastewater purification systems wherever possible;
- introduce the “circular” mode of industrial water supply; and
- accept an environmental tax on water that would cover all delivery, management and purification costs.

# Seawater and Freshwater

Complete the sentences	
Seawater:	Freshwater:
covers _____ % of the Earth's surface.	accounts for only _____ % of global water reserves.
can be found in _____	can be found in _____
contains _____	does not contain _____
Name the world's principal oceans:	Name a few nearby rivers, lakes or reservoirs:
Which seas are nearest where you live?	

Fill in the following table with YES or NO				
	Seawater		Freshwater	
	Yes	No	Yes	No
<b>This kind of water is used for:</b>				
navigation				
shipping				
fishing				
relaxation and entertainment				
extraction of salt and other minerals				
irrigation				
drinking and cooking				
<b>This water is polluted by:</b>				
wastewater				
waste/garbage				
chemicals/heavy metals				
pesticides/fertilisers				
sludge				
radioactive waste				
fishing nets and accessories				
plastic products				
sediments as a result of erosion				
other				



# How to Save Water at Home

## Assignment: How do I brush my teeth?



### Conditions

The population of your town is 30,000. Let's suppose that most people brush their teeth while running the tap, and others (less in number) turn it on only for rinsing their toothbrushes and mouths.

The flow-rate of water is 2 litres per minute and on average it takes three minutes for most people to brush their teeth .

The second approach (periodically turning the water on/off for rinsing only) results in half the amount (approx. 1 litre) of water used.

### Questions

A: How much water would be used per year if everyone in town ran the tap constantly while brushing their teeth twice a day?

B: How much water would be used per year if everyone ran the tap only to rinse their mouths and toothbrushes?

C: How much water can be saved per year if everyone follows the second example?

## Assignment: How do I shave?

### Conditions

Let's suppose that the population of your town is 40,000. Assume that half are men, and half of the men shave every morning. Most of those who shave do so while running the tap constantly, while others run the tap only to rinse their shavers and faces.

An average shave takes about 6 minutes. Tap water flows through a semi-open spigot at about 2 litres per minute. The average amount of water used for rinsing only is only 1 litre per minute.

### Questions

A: How much water is being used annually if, every morning, all shavers run the tap constantly while shaving?

B: How much water is used if these same shavers run water only to rinse their shavers and faces?

C: How much water could be saved every year if all shavers follow the second example?



# Stages of Wastewater (Sewage) Treatment



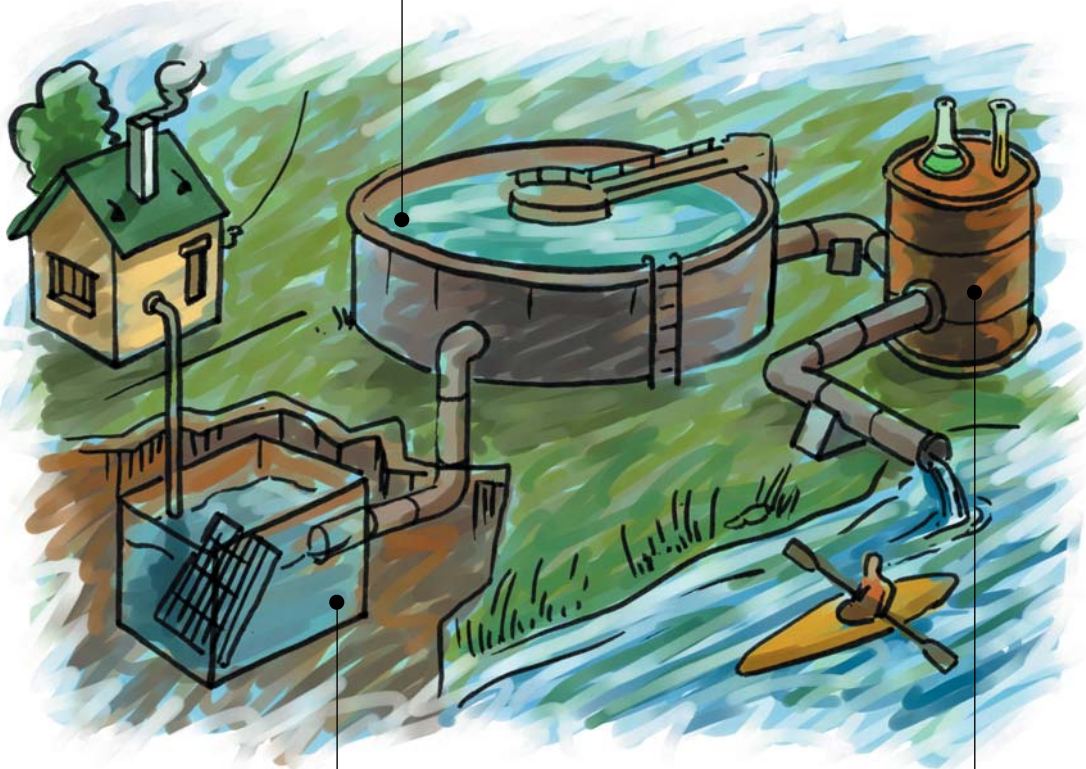
2

**Secondary sewage treatment** is a biological process in which aerobic bacteria are used to remove up to 90 percent of biodegradable, oxygen-demanding organic waste.

Sewage is usually pumped into a large tank and mixed for several hours with bacteria-rich sludge and oxygenating air bubbles to facilitate the degradation of micro-organisms. The water then goes to a sedimentation tank, where most of the suspended solids and micro-organisms settle out as sludge.

The sludge produced from the primary and secondary treatment is broken down by anaerobic digestion and then incinerated, dumped in a landfill or applied to land as fertiliser.

Even after secondary treatment, however, wastewater still contains some oxygen demanding wastes, suspended solids, 70 percent of its phosphorus (mostly as phosphates), some nitrates and toxic metal compounds.



**Primary sewage treatment** is a mechanical process that uses screens to filter out debris such as stones, sticks and rags.

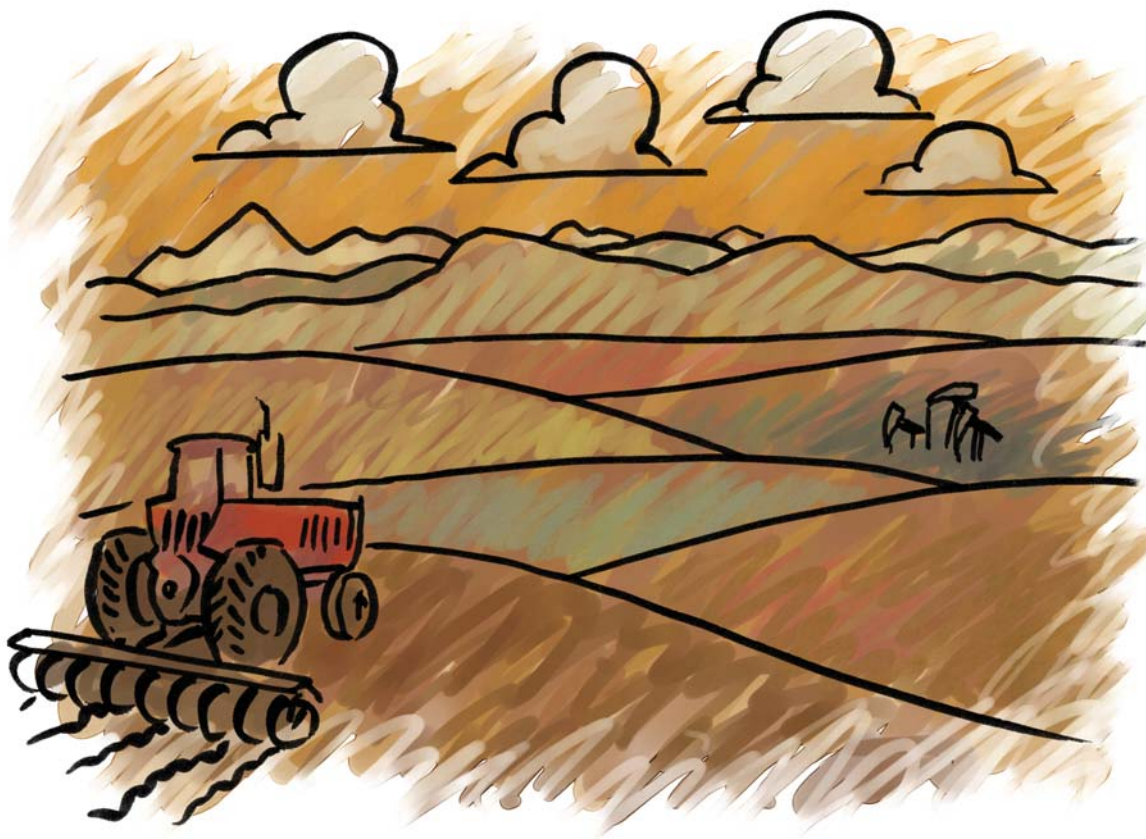
1

**Advanced sewage treatment** is a series of specialised chemical and physical processes that remove specific pollutants left in the water after primary and secondary treatment.

Advanced treatment is rarely used because of high building and operating costs. Despite the expense, however, advanced treatment is used for more than one-third of the population in Finland, the former West Germany, Switzerland and Sweden, and, to a lesser degree, in Denmark and Norway.

3





## Soil: Our Wealth

Authors: Jerzy Sadowski, Malgorzata Podkanska

<b>Major concept</b>	Soil is the foundation of life on Earth.
<b>Duration</b>	2-3 class periods
<b>Time of year</b>	Any
<b>Place</b>	Classroom, laboratory
<b>Materials</b>	Four glass cylinders, two sieves with small holes, soil samples, dyeing agent, the Green Pack video cassette
<b>Subjects</b>	Biology, geography, environmental science
<b>Aims</b>	To help students appreciate the various roles that soil plays in nature
<b>Methods</b>	Lecture, experiment, discussion

### Introduction

Soil is the topmost layer of the Earth's surface, and the base upon which our planet's land-life has developed. Soil, in a sense, is alive because it is inhabited by many living organisms. Moreover, it is always undergoing a process of formation or destruction (erosion).

Soil is an essential component of all terrestrial ecosystems. In contrast with the concerns over the atmosphere and hydrosphere, the need to protect the soil has only recently come into consideration. Soil is static and thus acts as an enormous receptacle for any type of pollutant that can be activated by different triggers (such as acidification) and released into the environment. Since these substances reside much longer in the soil than in air or water, adverse effects can remain hidden for a long time.





Unlike air and water, soil can be owned as personal property, which renders soil conservation and protection policies subject to acceptance by landowners and managers, and difficult to enforce.

The soil serves as:

- a basis for biomass production and a food source for animals, plants and humans (it is also where animal and plant decomposition takes place);
- a filter, buffer and transformer (soil refreshes and purifies underground waters and acts as a natural filter and stabiliser);
- a habitat and gene reservoir (many plants and animals live in and develop the soil);
- a foundation (i.e. the surface upon which buildings and infrastructural networks are built);
- a source of raw materials for building and furnishing purposes; also for sources of renewable energy (e.g. hay, straw, peat, wood); and
- a cradle of architectural and historical heritage.



Unfortunately, the Earth's soil layer is constantly decreasing — and, in many places, its quality is worsening. Much care and effort is needed to halt the process of soil destruction processes so that it continues to be able to perform all its functions normally.

The most serious problems and threats to the soil are associated with erosion, acidification, pollution, compaction and salinisation.

## Activities

### Introduction

- 1 Begin class by asking the students to write some names of organisms inhabiting the soil on the board. How much do the students know about what lives in the soil, compared to life-forms that live elsewhere?
- 2 Acquaint the class with the information presented on the CD-ROM. Emphasise the fact that, unlike air- and water protection, the need for soil protection has only recently become a topic of concern. Also, point out that because soil often lies beneath private property, it is more difficult to properly regulate and enforce measures to protect the soil than it is for air and water.
- 3 Show the class the video clip *Soil: Our Wealth*, and ask the students to describe how soil is formed. What are its main functions? What are the biggest threats to the soil?

### Soil functions: a filter and buffer (an exercise)

- 1 Place two sieves with small holes (a fine cloth may also work) over two glass cylinders. Fasten the sieves or lint to the cylinders with rubber bands.
- 2 Place a handful of loamy soil on one of the sieves, and an equal quantity of sandy soil (or coarse-grained sand) on the other.
- 3 Pour equal volumes of water into two small cylinders.
- 4 Add a drop of some bright-coloured dye (e.g. ink) to each of them.
- 5 Switch-on a chronometer and carefully pour coloured solution onto the soil samples.



- 6 Ask the pupils to time the filtering period while watching the colour change in the larger cylinders.

The coloured water passes quickly through the sand, while also retaining its colour. The solution takes much more time to pass through the loamy soil, and is also drained of most of its colour. Soils containing loamy particles (loam, mud) function as natural filters, while sandy, rocky and gravelly soils contribute to the renewal of underground waters. At the same time, due to their density and ability to retain different substances, loamy soils are more vital and richer in mineral substances. Soil particles can be removed fairly easily. Point out to students that there is much less plant life that grows, for example, on the rocky surface of a mountain. Much more plant life exists in sub-mountain regions and on plains. The hardy species that do exist in mountain environs have adapted to the rougher climate and poor soil conditions, and most of them are protected by law.

### Brainstorm

Ask your students the following questions: which everyday objects are made from clay (loam)? (bricks, tiles, flowerpots) and what else can be made from it? (porcelain from white clay, "kaolin" or "china clay," and clay used in ceramics and sculpture). Pay attention to the choice of clay and kaolin for different purposes, and the methods used for processing the materials (modeling-drying-baking; drying-baking-glazing).

### Discussion

Read the excerpt from Plato's *Critias* and discuss its relevance today. Ask the students the following questions:

- Has soil erosion and destruction become a problem only in the last 100 years?
- Is soil damaged naturally or from human impact?
- In ancient Greece, 2,500 years ago, there was a cultivation ban on sloped terrain. At the same time, peasants were offered incentives to plant olive trees. What was the logic behind this?
- What is the influence of soil destruction on water reserves?
- Do you think that the parallel made by Plato between the Earth and a sick man is an appropriate illustration?
- What comparisons would you draw to describe some of today's industrial landscapes?
- Which dangers to the soil do we face today? And is there a tendency toward desertification of particular regions in our country?
- How can we help to counteract progressive destruction of the soil?

### Follow-up

- Distribute a copy of the text from Wislawa Szymborska on page 31 to the students and tell them to write down their impressions and/or a brief essay after they have read it. Encourage students to share what they have written with the class.



## Excerpt from *Critias*

Environmental destruction was an issue of concern for rulers of ancient Greece as early as the sixth century B.C. The lawmaker Solon proposed a ban on cultivating the hillsides in order to prevent erosion. The ruler Pisistratus rewarded peasants for planting olive trees instead of cutting down forests and grazing livestock.

Two-hundred years later, Plato wrote of land devastation taking place in Attica:

“And so, like it is on the small islands, our recent land has become looking like bones of a sick body if compared with the former times: all the fat and soft land has come down and the bold skeleton remained only. In those past times our land was intact, with high hills, and the so called now stony plains had an abundant lush land, the mountains were covered by broad forests. (...) Among our mountains there are such which now feed bees only, but still roofs made of trees cut not very long time ago are preserved there (...), and the land was giving unbelievably rich pasture to the flocks. The water which Zeus was sending was a fruitful one, not like now when it is fading away with no use, flowing to the field out of the bold land.”

— **Plato**, from *Critias*

## Soil Protection

Each of us can contribute to soil protection by following these simple examples:

- First of all, help to reduce the amount of garbage. Buy products in multiple-use or recyclable packaging only — then return the packaging for reuse or recycling.
- When going on holiday or a short trip, bring multiple-use dishes and cups instead of single-use items made of paper, plastic or carton.
- When eating in a picnic area, clean up afterwards.
- When in wilderness areas, keep to marked paths and try not to create new ones.
- Prepare fires only in areas specially designated for that purpose.



## Wisława Szymborska's Disgust for Litter



We are facing all the problems associated with the unavoidable expansion of cities, districts and industrial centres. In this process, the protection of nature cannot merely be a consideration, it must be obligatory. Otherwise we will suffer; we will torture, trample upon, poison and suffocate ourselves. But before that we will go crazy. And before that we will sink down in waste.

It is spring already, and the season for weekend outings, tourism, vacations, etc. is just starting. Like every year, across our meadows, forests, river banks and lakes, there will once again be a profusion of paper, bottles, cans, gnawed bones, peelings, and bottles again, and cans again, as well as plastic packs, cream boxes, rubber products, stained pocket knives and rags. One source of all this abundance will be the same people who, crossing the doorstep of their own homes, immediately put on their slippers — the same people who slap their children's bottoms for even the smallest stain on the tablecloth. But in the bosom of nature they relax, i.e. everything that falls from their hands remains right there. When departing, they don't take so much as a glance around for the rubbish they have left.

This phenomenon is not something new but it becomes more and more frightening each year. When I go on excursion, my first job is to clean up the meadow within a radius of about two hundred metres. I collect unbelievable quantities of garbage and heap it in a specially shovelled pit. For a few days nature rewards me with its beauty. But come Saturday and Sunday, I am reminded that there are no longer places so isolated that on the weekend you won't see at least two private cars and a bus full of excursionists. And here it is — on Monday I begin cleaning again, and the cycle is repeated. Unfortunately, throwing rubbish in the grass is not the worst mess a man can create today. Some people show more imagination and throw all their garbage into the water. If it's glass containers we're talking about, they take special care to see that it is broken. And something which makes me wonder every year — the issue of excrement. I meet with it very often in open spaces — like a challenge to the blue sky and the winds of the four cardinal directions. The toilet tissue thrown nearby leaves no doubt of its human origin. Don't be angry that I — as is natural for a poet — write of such things rather than seeking psychological treatment. In fact, here I focus precisely on problems of the spirit! I describe its absence.

**Wisława Szymborska**, Krakow, 1996, Nobel Prize winner for literature







## Need for Nature

Author: Kliment Mindjov

<b>Major concept</b>	Every species has the right to live, or at least to struggle for life, simply because it exists.
<b>Duration</b>	1-2 class periods
<b>Time of year</b>	Any
<b>Place</b>	Classroom
<b>Materials</b>	Posters, Green Pack video cassette
<b>Subjects</b>	Biology, geography, sustainable development
<b>Aims</b>	To appreciate the extraordinary significance of biodiversity and the danger of accelerated species loss
<b>Methods</b>	Lecture, discussion, brainstorming, video presentation

### Introduction

All living creatures on Earth can be grouped into species — groups of organisms that look alike, have a similar way of existence and behaviour, and share a like chemical composition and genetic structure. Organisms of a given species that reproduce sexually must be able to procreate prolifically.

One of the most important and precious resources on Earth is its diversity of biological species, known as biodiversity. This resource is made up of three components:

- **genetic diversity**, which includes a variety of individuals within one and the same species;
- **species diversity**, which presently includes, according to biologists, between 15 million and 40 million species on Earth (though scientists have succeeded in classifying only 1.75 million); and

- **ecosystems diversity**, which includes a variety of woodlands, deserts, fields, rivers, seas, oceans and other bio-communities interacting with each other and with the non-living environment.

Each living organism is in itself a resource of genetic information that allows it to adapt to changes in its environment. For millions of years new species have emerged, while those that have failed to adapt have disappeared. Species extinction is a natural process. The speed of this process, however, has accelerated rapidly with the rise of urban development and the expansion of human activity.

## Activities

- 1 Explain to the class the extraordinary significance of animal and plant diversity. Use the text on Man and Biodiversity and additional information from the CD-ROM.
- 2 Illustrate the ways in which humans depend on biodiversity. Plants and animals provide a diverse variety of food, materials, energy and chemicals.
- 3 Hold a brainstorming session on how nature provides the foundation for our economy and society. Write various examples on the board. When the exercise is completed, discuss the text below on what Nature Provides.
- 4 Present the educational video Biodiversity and Species Loss included on the video cassette. Organise subsequent discussions on the questions asked at the end:
  - Why is biodiversity important to people?
  - What causes species to go extinct?
  - What can we do to protect plants and animals?
- 5 Show the video clip Time is Running Out, included on the video cassette, and discuss its message. Invite the pupils to write a short essay based on both the video and the subsequent discussion.

## Follow-up

- Give pupils an assignment to search for additional information about specific threats to biodiversity in your country. Allow them to use the CD-ROM and various Internet sources as well.

## Nature Provides

- Nature provides us with raw materials — food, fish, timber and construction materials, forest products, fodder, genetic resources, medicines, dyes, rubber, etc.
- Nature provides us with a natural habitat.
- Nature performs pollination.
- Nature provides biological control over diseases and pests.
- Nature recycles natural wastes, alleviates pollution and maintains the soil.
- Nature regulates the cycle of nutrients and organic substances.
- Nature regulates atmospheric processes, the hydrological cycle and natural disasters.
- Nature is a place for rest and refreshment, as well as a source of culture, education and scientific discoveries.





## Man and Biodiversity

Today, as never before, natural ecosystems and biological diversity are in serious danger:

- About 50,000 biological species become extinct every year. For the first time in natural history, one specific species — Man — has become a powerful factor in ecosystem destruction.
- Tropical rainforests and other natural ecosystems are being lost or damaged due to agricultural expansion, the development of transport, urban growth, the diversion of rivers for irrigation, and pollution.
- Bird species around the world are decreasing, while one-fourth of all mammals are in serious danger of extinction.



Throughout the course of evolution, plant and animal species have appeared and disappeared — some have remained relatively unchanged while others have evolved or divided into subspecies.

Climate change, ice ages in particular, were probably responsible for the development of endemic European subspecies. With the exception of major geological or cosmic events (such as volcanic eruptions or meteoric collisions), the decline and appearance of species usually takes place gradually and over long periods of time.

During the past 10,000 years, however, the most dramatic impacts on the environment have resulted from the relatively rapid and omnipresent changes caused by human activity. Today it is arguable that there is no place in Europe below 2,000 meters in altitude that has not been altered by humans in one way or another.

Human impact causes drastic changes to the environment. Many of these changes occur too fast for species to adapt, which results in a progressive decrease in the number of plant and animal species.

Many more species have changed or disappeared in Europe than in other parts of the world. For example, 80-90 percent of the European continent's total area was once covered by forests. They now occupy only 30 percent. The continent's natural rivers are also under extreme pressure.

A large number of inland marshes and peat bogs are gradually disappearing. The Iberian Peninsula, for example, has lost about 60 percent of its wetlands. Approximately 6 percent of the continent's area is protected, but the measures undertaken are not equally strict and efficient everywhere. At present, the following shares of different taxonomic groups are disappearing or threatened by extinction: about 53 percent of fish species, 45 percent of reptiles, 40 percent of birds, 40 percent of mammals and 21 percent of the total 12,500 higher plant species.

Loss of natural habitats, land fragmentation, pollution, overexploitation and the introduction of exotic species are considered the major threats to biodiversity.



# Biodiversity in the River Valley

Authors: **Malgorzata Cydeyko, Izabela Majstruk, Barbara Kekusz, Honorata Waszkiewicz, Tatyana Miteva**

<b>Major concept</b>	Irresponsible human activities can seriously damage river ecosystems.
<b>Duration</b>	<ul style="list-style-type: none"> <li>• Introductory lesson — 1-2 class periods</li> <li>• Outdoor (on-site) lessons — 2-4 class periods</li> <li>• Concluding lesson — 1-2 class periods</li> </ul>
<b>Time of year</b>	Spring (April-June)
<b>Place</b>	<ul style="list-style-type: none"> <li>• Classroom</li> <li>• Two points for sampling along the river: the first in a well-preserved area, far from household and industrial pollution sources, and the second in a wetland system drastically changed by human activities (near a dyke, along a concrete-embedded bank or close to a wastewater outlet)</li> <li>• Bio-laboratory</li> </ul>
<b>Materials</b>	Writing and drawing tools, topographic map, lenses, binoculars, tape recorder, camera, field identification guides for plants and animals, glass jars, test-tubes, dipping nets, sieves, forceps, methyl-blue test solution, tape measure, short ropes for setting test areas of 1 square metre each, worksheets
<b>Subjects</b>	Biology, chemistry, ecology, sustainable development
<b>Aims</b>	<ul style="list-style-type: none"> <li>• To become familiar with the biodiversity of a river and to help students understand the importance of its conservation;</li> <li>• To appreciate the complex and dynamic interrelations between biodiversity and the state of the environment;</li> <li>• To develop skills for applying practical methods of evaluation on the state of the environment and biodiversity;</li> <li>• To appreciate the need to protect biodiversity and to use it in a sustainable manner.</li> </ul>
<b>Methods</b>	Associative game, lecture, discussion, observation, field (on-site) research, work in small groups



## Introduction



Biodiversity in Europe is under constant pressure from urbanisation. One area under extreme pressure, but very often forgotten, is wetlands — marshes, swamps, shallow coastal areas and bays. A large number of inland swamps and marshes are gradually disappearing in Europe.

Wetlands and rivers are essential elements of the natural balance, serving as virtual nurseries for many different kinds of water animals and plants. They also serve as natural media for algae and plankton, which are staple foods for many animals, including fish, turtles, crabs and herons.



## Activities

### Introductory lesson

- 1 Have the students fill in the gaps in these sentences:
  - If I were a tree by the river I would be a ..... because .....
  - If I were a blade of grass by the river I would be a ..... because .....
  - If I were a fish in the river I would be a ..... because .....
  - If I were an amphibian by the river I would be a ..... because .....
  - If I were a reptile by the river I would be a ..... because .....
  - If I were a bird by the river I would be a ..... because .....
  - If I were a mammal by the river I would be a ..... because .....
  
- 2 Ask the pupils to explain their choices. Clarify how each of the chosen plants and animals has adapted to life in/by the river.
  
- 3 Discuss the following issues with the class:
  - Which factors define biodiversity? Which factors does it depend on? (*availability of food, water, oxygen, relevant habitat*)
  - Why do the border zones between water and terrestrial habitats (wetland ecosystems) have a broader diversity of species than other habitats?
  - What are the threats to the biodiversity of river systems? (*destruction of habitats, contamination of water and soil, changing and concrete-embedding of the riverbed*)
  - What is the significance of a river's biodiversity for nature? for man?
  
- 4 Stress the fact that different organisms in each ecosystem are connected with each other. An impact on one of them may affect the others. Use additional information from the Biodiversity chapter of the CD-ROM.
  
- 5 Prepare the class for the forthcoming outdoor lessons:
  - Introduce the lesson.
  - Divide the class into smaller groups as follows:
    - water purity experts;
    - water biodiversity experts;
    - wetland flora experts;
    - wetland fauna experts; and
    - eco-police.
  - Distribute the relevant fact sheet to each group and explain each process.
  - Provide all necessary instructions, worksheets, materials, tools and supporting literature (manuals and identification guides).

### Outdoor (on-site) lessons

Organise the outdoor lessons at two different points along the river that offer varying biodiversity, landscape features and water pollution levels. Apply the same methodology for assessing:

- biodiversity
- water quality (based on observation);
- plant diversity
- animal diversity; and
- human impact.

## Concluding lesson

- 1 Invite the teams to present the results of their on-site studies. Draw conclusions on the status of biodiversity in the river ecosystems and its dependence on water purity and human activities. Formulate proposals for improving the purity of the water basins and conserving their biodiversity. Support the pupils' work with information from the Each of Us Can text below.
- 2 Think of ways to disseminate the results of the exercise.

### Follow-up

- Organise an eco-action for decontaminating sections of the river bank or for strengthening eroded parts of the bank by planting trees.
- Send summaries of the results of the exercise and the proposals to relevant organisations and institutions (e.g. a municipal ecology expert and/or the mayor, the regional environment and water council, the ministry of environment).
- Organise an exhibition, such as a green information wall or a mobile display.
- Get in touch with local journalists and organise a radio or TV broadcast.
- Post a report on local biodiversity on the Internet.



### Each of Us Can...

#### Each of us can protect wetlands by not:

- wasting water;
- throwing rubbish into bodies of water;
- cutting down trees and bushes on the shoreline;
- burning shoreline vegetation;
- using unnecessary chemical household products;
- disturbing wetland wildlife;
- using wetland resources recklessly; or
- waiting for someone else to plant a tree on the shoreline;

#### Together we can:

- insist on a new attitude towards the wetlands, including legislative measures and economic practices;
- require strict controls over the use of water resources and water pollution;
- appeal for the urgent restoration of lost wetlands; and
- protect shoreline vegetation.

BirdLife International, 2002



# State of the Water's Biodiversity

(for water biodiversity experts)



A. Collect and analyse some organisms from the bottom of the body of water, from the silt and from the surface. Apply the biological indicators' system for evaluating the surface water quality:

- 1 Collect animals found on the underside and on the surface of a few (3-5) large stones by using dipping nets, sieves and forceps. Place them in a glass container. Observe each specimen one by one, and identify its taxonomic classification. Carefully return all identified and unidentified organisms to the river.
- 2 Take three to five samples of silt from the bottom. Wash the samples through the sieve until only the organisms and larger stones remain. Record the results and then return everything to the river.
- 3 Collect the animals swimming on the water surface by moving the dipping nets in a figure-8 pattern along the surface (the mouth should be perpendicular to the river bottom). Take three to five samples. Identify the organisms after placing them in a jar and then return them to the water.

Biological System for Determining Surface Water Quality				
Animal groups	Group index	Distribution according to affinity to a certain water quality*		
		Clean water	Fairly clean water	Polluted water
1. Dragonfly larvae ( <i>Odonata</i> )	8	■	●	
2. Leather-winged beetle larvae ( <i>Cantharididae</i> )	8	▲		
3. Mayfly larvae ( <i>Ephemeroptera</i> )	10	■	■	
4. Crawfish ( <i>Astacus sp.</i> )	10	■	■	
5. Planarian flat worms ( <i>Tricladida</i> )	4		●	■
6. Megalopteran larvae	4		▲	
7. Water measurers ( <i>Hydrometridae</i> )	5		▲	
8. Water fleas ( <i>Cladocera</i> )	5		▲	
9. Caddis fly larvae ( <i>Trichoptera</i> )	5	●	■	
10. Ark shells ( <i>Bivalvia</i> )	6	●	■	
11. Water beetles	5		▲	
12. Freshwater shrimp ( <i>Gammarus sp.</i> )	6		▲	
13. Sludge worms ( <i>Tubifex sp.</i> )	1		●	■
14. Leeches ( <i>Hirudinea</i> )	2		●	■
15. Snails ( <i>Gastropoda</i> ) — Pond snails ( <i>Limnaeidae</i> )	3		●	■
16. Isopoda shrimp — Water lice ( <i>Asellus aquaticus</i> )	3		●	■

\*Note The symbols indicate what probability there is of finding the given animal in certain types of water.

- Low probability
- Medium probability
- ▲ High probability





## State of the Water's Biodiversity continued



















B. Determine the water quality on the basis of the following criteria:

- Which group of organisms is the most common?
- Which other groups are represented?
- What is the number of specimens by groups, and which of the above water types are they found in?

C. Calculate the biotic index, which can be determined by multiplying the number of organisms found in each group by the corresponding group index taken from the table. Total the results and find the mean average by dividing the total score by the number of sampled organisms.

The biotic index varies from 0 (no life found) to 10 (diverse life forms). A higher index indicates clean water, a medium index indicates natural water, and a low index indicates pollution. Nought values are rarely seen.

Who Lives in the Water			
1 	2 	3 	4 
Dragonfly larvae ( <i>Odonata</i> )	Leather-winged beetle larvae ( <i>Cantharididae</i> )	Mayfly larvae ( <i>Ephemeroptera</i> )	Crawfish ( <i>Astacus sp.</i> )
5 	6 	7 	8 
Planarian flat worms ( <i>Tricladida</i> )	Megalopteran larvae	Water measurers ( <i>Hydrometridae</i> )	Water fleas ( <i>Cladocera</i> )
9 	10 	11 	12 
Caddis fly larvae ( <i>Trichoptera</i> )	Ark shells ( <i>Bivalvia</i> )	Water beetles	Freshwater shrimp ( <i>Gammarus sp.</i> )
13 	14 	15 	16 
Sludge worms ( <i>Tubifex sp.</i> )	Leeches ( <i>Hirudinea</i> )	Snails ( <i>Gastropoda</i> ) — Pond snails ( <i>Limnaeidae</i> )	Isopoda shrimp — Water lice ( <i>Asellus aquaticus</i> )



# Water Quality

(based on observations)



A. Make a qualitative evaluation of the water status by observing and ranking its external features. On the Water Observation Form, tick the boxes corresponding to the actual water status you have observed. The number of positive answers in each particular column will determine the category of water — clean, natural or polluted.

Water Observation Form			
Results	1	2	3
	4	5	6
	7	8	9
	10	11	12
	13	14	15
	16	17	18
Total			
Water status (exterior)	Clean	Natural	Polluted
Expected range of biodiversity	Average	High	Low
Expected number (population strength) of particular species	Low	Average	High

**Questionnaire:**

1. The water is clear.
2. The water is somewhat muddy.
3. The water is very muddy.
4. The water is colourless.
5. The water has a blue-green colour.
6. The water is dark grey or cinnamon-coloured.
7. There is no odour.
8. There is a smell of soil or algae.
9. There is a smell of rotten matter or sewage.
10. The bottom is clean.
11. The bottom is covered with slippery or bright silt.
12. The bottom is covered with dark or black silt.
13. There are rocks with no growth on them.
14. There are rocks with a layer of blue, green or greenish-brown weeds growing on them.
15. There are rocks with a layer of greyish-green or cinnamon-coloured weeds growing on them, and are black on the bottom.
16. The water's surface is clear.
17. There are leaves, insects and larvae on the water's surface.
18. The water's surface is littered with waste, debris, oily spots or foam.

B. Take a sample of the water and place it in a test-tube. Add methyl-blue solution. If the colour changes from blue to clear, this is a sure sign of organic compounds. Pale-coloured foam on the river bank is also an indicator of organic activity.



# Plant Diversity at the River

(for wetland flora experts)



A. Examine the various plant habitats — shoreline bar, bank, meadow, flood forest, dyke (embankment), etc. — to determine the character of your river sector.

B. Investigate the diversity of vegetation communities in work areas of 1 square metre for open grassland communities, and 10 square metres for forest and brushwood areas.

No.	Community type	Plant species	Number of specimens
1.			
2.			
3.			
	<b>Total</b>	<b>Average number of species</b>	<b>Average number per square metre</b>
1.			
2.			
3.			
.....			

**Instructions:**

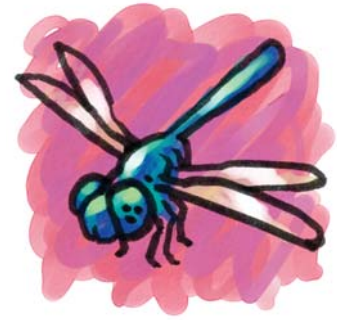
- Use a nature guide to identify the different species of plants.
- Prepare a topographic map prior to the study and mark the investigated squares.
- If a given species cannot be identified, simply record it as a grass, bush or tree, and record its physical characteristics.
- Photograph different plant habitats and individual specimens.

C. Analyse the vegetative diversity by counting the number of species in each community. Calculate the average number of species for the whole studied area. Determine the dominant (most numerous) plant species. Calculate the approximate average number of plants per square metre and per community. Compare the results obtained from different communities.



# Animal Diversity around the River

(for wetland fauna experts)



A. Observe the different habitats of the studied river sector — shoreline bar, bank, meadow, flood forest, dyke (embankment), etc.

B. Investigate the diversity of animal species and record your findings in the table.

No.	Community type	Animal species found	Exact or approximate number of specimens
1.			
2.			
3.			
	<b>Total</b>	<b>Average number of species</b>	<b>Average number per square metre</b>
1.			
2.			
3.			
.....			

**Instructions:**

- Use the field identification guides for animals.
- Mark the investigated squares on a topographic map prepared prior to the study.
- If a species can not be readily identified, simply record its presence and describe its features so it can be identified later.
- Photograph particular communities and some characteristic animals.
- Describe the sounds made by different animals and record them with a tape recorder. This will assist you in future identification.
- Search for animal trails. Write down the number of animals and species who left the trails found. Draw the trail contours in life size — this will help you in further identification.

C. Analyse the animal diversity by counting the number of species in each community. Calculate the average number of species for the whole studied area. Determine the dominant (most numerous) animal species. Calculate the approximate average number of animals per community. Compare the results obtained from different communities.





# Human Impact

(for eco-police)



**Investigate the river's environment and record the following information:**

- 1 Presence of people and their activity at the moment

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- 2 Signs of direct human impact (record the activities — hunting, fishing, grazing, fire-making, tree-cutting, etc., along with the evidence)

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- 3 Traces of indirect human impact (e.g. contamination with household products or other waste)

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- 4 Dead or wound animals (species, number, and cause)

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- 5 Damaged vegetation (species, number, and cause)

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- 6 Are the water and the river bank polluted by household waste? Determine that and estimate the pollution degree — low, medium or high

---

- 7 General evaluation of your river sector

---

Prepare a report.



## Treasures of the Forest

Authors: **Anna Gajer, Mirosława Sliwka, Honorata Waszkiewicz, Tatyana Miteva**

<b>Major concept</b>	In addition to providing a habitat for wild plant and animal species, forests are key to maintaining the world's ecological balance
<b>Duration</b>	<ul style="list-style-type: none"> <li>• Introductory lesson — 2 class periods</li> <li>• Outdoor (on-site) lessons — 2-4 class periods</li> <li>• Concluding lesson — 2 class periods</li> </ul>
<b>Time of year</b>	Spring, summer, autumn
<b>Place</b>	<ul style="list-style-type: none"> <li>• Classroom</li> <li>• 2 study sites — one in a natural forest ecosystem, the other in an artificial forest plantation</li> <li>• State forestry</li> </ul>
<b>Materials</b>	Topographic map of the area, binoculars, tape recorder, camera, field identification guides for plants and animals, tape measures, worksheets
<b>Subjects</b>	Biology, geography, ecology, sustainable development
<b>Aims</b>	<ul style="list-style-type: none"> <li>• To study the biodiversity and ecosystems of a nearby forest;</li> <li>• To develop practical skills for studying the environment;</li> <li>• To help preserve and restore forest resources while taking into account the need to conserve biodiversity.</li> </ul>
<b>Methods</b>	Lecture, discussion, observation, field research, role-playing



### Introduction

Forests provide us with everyday commodities such as timber, fuel, food and pharmaceuticals. By providing a habitat for plants and animals, natural forests also play a major role in maintaining biological diversity and healthy ecosystems.

Trees, the characteristic element of a forest, are invaluable to the environment. They filter out pollution and pathogenic micro-organisms from the air, regulate the water cycle, produce oxygen and bactericides, and provide the atmosphere with ozone. However, a forest is not simply a collection of trees; forests are dynamic, complex eco-systems that take several lifetimes to form. Protecting them is a wise investment in our future environment.

### Activities

#### Introductory lesson

- 1 Present the material in the introduction along with additional information from the CD-ROM chapters on Biodiversity and Forestry, and the text on The Forest at the end of the lesson.
- 2 Organise a role-play with the students. Have them act out a scene in the forest where conflicts over forest resources are resolved. Have the students write a screenplay and act it out for the class. Assign the following roles:
  - hunter (poacher);
  - picker of forest herbs used for their roots;
  - mushroom-gatherer who pulls up the mushrooms instead of cutting them;
  - tourists;
  - journalist;
  - state forestry officer.

Discuss the issues raised by the skit and how the characters reacted. Was it realistic? How were the characters portrayed (e.g. was the officer sympathetic or more of an authority figure)?

### 3 Prepare the class for the outdoor lessons:

- Introduce the lessons and student fact sheets.
- Divide the class into smaller groups (teams) as follows:
  - ecosystem experts;
  - flora experts;
  - fauna experts;
  - eco-police.

Provide the pupils with appropriate instructions, worksheets, materials, tools and identification guides.

#### Outdoor lessons: Natural or artificial forest

1 Organise an expedition to a forested area featuring both a natural forest and an artificial plantation for industrial timber production.

2 Go for a walk in a natural forest. Identify some common plant species of the given forest ecosystem. Pay attention to the variegated plant communities and determine their role in preserving the natural landscape, as well as in maintaining the ecosystem's biological balance. Explain that there are several plants that function as bio-indicators by providing information about the living environment. Have them list the factors affecting the development of plant communities. These plants grow in conditions according to what they need in terms of nutrient compounds, water exchange, pollination, etc.



3 Have the students locate plants that indicate:

- the four cardinal points (i.e. north, south east, and west);
- the most common wind direction;
- an area receiving frequent sunshine;
- an area receiving infrequent sunshine;
- the season;
- rainfall approaching;
- moist soil;
- poor soil; and
- it is time for bees to collect nectar.

4 Introduce some bio-indicator plant species to the class:

- Sour dock (*Rumex acetosa*), trefoil (*Trifolium pratense*), spurrey (*Spergula vernalia*), sweet vernal grass (*Anthoxanthum odoratum*), creeping soft grass (*Holcus mollis*) and pansies (*Viola wittrockiana*) all signify soil acidity.
- The nettle (*Urtica*) indicates that the soil is rich in nitrogen.
- The wall pepper (*Sedum*) is a sign of dry soil.
- The alder (*Alnus*) suggests that the soil is moist.

5 Have the pupils create individual lists of bio-indicator plants.



- 6 Organise a field study of the natural forest and the artificially forested areas. Apply a common methodology for filling out the fact sheets on
- Ecological Factors (for ecosystem experts) on page 48;
  - Forest Plant Diversity (for flora experts) on page 48;
  - Forest Animal Diversity (for fauna experts) on page 49; and
  - Human Impact (for eco-police) on page 43.

## Concluding lesson

- 1 Discuss the following issues with the class, using the results from the field study:
- Which factors determine and regulate biodiversity? (*availability of food, water, oxygen, appropriate habitat*)
  - Why is there a higher diversity of species in the border areas of a forest?
  - Why are natural forests richer in species than artificial varieties?
  - What are the dangers to biodiversity in forest ecosystems? (*habitat destruction, pollution, forest fires, uncontrolled tree-cutting etc.*)
  - What is the significance of forest biodiversity for nature and man? (*forests produce 100 billion tonnes of oxygen and absorb 160 billion tonnes of carbon dioxide per year*)
  - Point out that different organisms in an ecosystem are inter-connected. Harm suffered by one species may in turn affect other species. Use additional information from the CD-ROM chapter on Biodiversity.
- 2 Organise a brainstorming on what can be done to protect forest biodiversity, using the information contained in the text at the bottom of page 47.

## Follow-up

Have the student perform individual or small-group assignments to learn more about practical issues. For example:

- Visit the nearest state forestry to learn about the major obstacles to protecting forest biodiversity in the region. Share what you have done. Take part in forestation activities. Explore the options for other practical actions you can join.
- Visit an experimental station for breeding forest species, or a selection laboratory. Get acquainted with the practical activities and particular methods for seed selection and conservation of seeds belonging to species being genetically valuable for the forest ecosystem. Track down the way of plants from the laboratory and the greenhouse to the forest.
- Make an exhibition of photos and information materials.





## The Forest



Although man has destroyed a considerable part of the ancient forests, mankind also plants a large number of trees. The forest industry has transformed many natural forests into timber production areas. Those tree species that present no potential income for the timber industry are eliminated. Quickly growing species offering high growth rates — and therefore bigger profits — are planted instead.

Forests in Germany present an excellent example. Just 150 years ago, broad-leaved deciduous species constituted two-thirds of all forests. Coniferous varieties made up the remaining third. Today the proportion is reversed because coniferous trees grow faster. In the Mediterranean region, to cite another example, poplar species are introduced into tropical eucalyptus or teak forests to serve as timber sources. Undesired insects in these homogenous forests are attacked with pesticides. By the end, there are so few animal species left that it is impossible to speak of biodiversity at all.

There are other alternative forestation methods, however. In recent years, planting mixed forests of various tree species has become increasingly popular. Although forests are cut and burned seven times faster than they are replaced, there is still hope. People around the world are coming to understand that trees and water are the basis of soil fertility and life in general, and that halting desertification will have a beneficial effect on the climate. New forests are therefore being planted everywhere.

**Barbara Veit, Christine Wolfrum, *A Book about the Forest*, PKE, Krakow, 1995**



## Protecting Forest Biodiversity

The following guidelines can help preserve forest biodiversity:

- favour local tree varieties when planting and restoring forests;
- eliminate clear cutting as much as possible minimum and adopt cutting schemes similar to natural forest processes;
- allow forests to recover naturally;
- allow dead trees, whether standing or fallen, to remain where they are;
- use only those timber production methods which respect biodiversity;
- use less ecologically sensitive forest areas for leisure and tourism;
- limit mass tourism in forests; and
- promote timber production technologies that produce less waste.

“Conservation of natural habitats...,” **BirdLife International**, 2002

## Ecological Factors (for ecosystem experts)



A. Compare the factors that determine the living environment in both natural and artificial forests. Fill in the table below with your answers.

No.	Ecological factors	Natural forest	Forest plantation
1.	Light/warmth		
2.	Air movement (wind)		
3.	Moisture		
4.	Nutrient base		
5.	Habitats		
6.	Other		

B. Take into account the role played by ecological factors in forming and supporting forest biodiversity.

## Forest Plant Diversity (for flora experts)



A. Determine the number and type of forest floors in each of the studied areas.

B. Investigate the biodiversity of plants by floors and fill in the table below.

No.	Floor	Plant species	Exact or approximate number of specimens
	Total	Average number of species	Average number per square metre

**Instructions:**

- Identify plants with the help of a field guide. If a species cannot be identified, simply record it as grass, bush or tree (but nevertheless write down its characteristics for later identification).
- Mark the investigated sites on a topographic map.
- Photograph various communities and some characteristic plants.

C. If you have already investigated other ecosystems, compare the results.



# Forest Animal Diversity

(for fauna experts)



A. Determine the number and type of forest floors in each of the studied areas.

B. Investigate the biodiversity of animals by floors and fill in the table below.

No.	Floor	Animal species	Exact or approximate number of specimens
	Total:	Average number of species	Average number per square metre

**Instructions:**

- Identify animals with the help of a field guide. If you cannot identify a given species, simply record its general characteristics and try to identify it later.
- Mark the investigated sites on a topographic map.
- Photograph various animals.

C. Identify the animals by their sounds. Record some animal sounds on a tape recorder for later use.

D. Search for animal trails. Write down the number of animals and species who left the trails found. Draw the trail contours in life size.

E. If you have already investigated other ecosystems, compare the results.



## Life in the Meadow

Author: Tatyana Miteva

<b>Major concept</b>	Overexploitation of pastures and meadows threatens the animals and plants that live there.
<b>Duration</b>	<ul style="list-style-type: none"> <li>• Introductory lesson – 2 class periods</li> <li>• Outdoor (on-site) lessons – 2-4 class periods</li> <li>• Concluding lesson – 2 class periods</li> </ul>
<b>Time of year</b>	Spring, summer
<b>Place</b>	<ul style="list-style-type: none"> <li>• Classroom</li> <li>• 2 study sites – one in a natural grassland ecosystem, and one in an artificial system used for agriculture</li> </ul>
<b>Materials</b>	Writing and drawing materials, topographic map of the area, lenses, binoculars, tape recorder, camera, field identification guides for plants and animals, tape measure, worksheets.
<b>Subjects</b>	Chemistry, biology, physics
<b>Aims</b>	<ul style="list-style-type: none"> <li>• To acquaint pupils with the biological diversity of meadows and pastures, as well as the functioning principles of the grassland ecosystem;</li> <li>• To develop practical skills for studying the environment;</li> <li>• To understand the importance of preserving grassland communities;</li> <li>• To compare the biodiversity of a natural ecosystem with that of an artificial system;</li> <li>• To foster responsible behavior for protecting and using grassland communities.</li> </ul>
<b>Methods</b>	Lecture, discussion, observation, field research, case study



### Introduction



Forest vegetation has been suppressed around the world. In such regions, the zonal grassland communities are evolving. In Eastern Europe these regions occupy considerable areas and are known as steppes. Their south-westernmost parts are bordered by Bulgaria and Romania — parts of the Danube plain and South Doubroudja. Contact points of this border zone with the zonal tree vegetation, combined with the variety of local conditions, predetermine a development of transitional forest-and-steppe ecosystems featuring a unique diversity of species.

In addition to zonal communities, there are also large non-zonal areas of well-developed meadowland and pastureland grass ecosystems, being classified into two major groups:

- **Primary** — Among the forest ecosystems there are places where the micro-conditions are not favourable for trees, so they are covered by grass instead. Such areas can be found on the seaside and riverside sands as well.
- **Secondary** — These usually replace destroyed, burned, uprooted and clear-cut forests, or abandoned but formerly arable lands.

### Activities

#### Introducing Grasslands

- 1 Introduce the character of grassland communities and the places where they evolve. Use the information contained in the introduction and the text on Pasturelands on page 52. Point out that the excessive exploitation of pastures and meadows is threatening their ecosystems directly (physical extermination) and indirectly (loss of habitat, places to hide and the nutrient base).



- 2 Have four volunteers each choose one of the case studies on page 53. Have each volunteer read the case aloud and discuss possible solutions with the class. Be sure that students provide arguments for their solutions.

### Outdoor (on-site) lessons

Prepare the class for the outdoor lessons.

- 1 Introduce the activity and the fact sheets on pages 43, 54 and 55.
- 2 Divide the class into smaller groups (teams) as follows:
  - grassland ecosystem experts;
  - flora experts;
  - fauna experts;
  - eco-police.
- 3 Provide the pupils with relevant instructions, fact sheets, materials, tools and supporting literature (manuals and identification guides).
- 4 Organise field lessons on two sites — one situated in a natural grassland ecosystem and the other in an artificial ecosystem (agricultural land) — using the following fact sheets:
  - Important Factors (for grassland ecosystem experts);
  - Grassland Diversity (for flora experts);
  - Animal Diversity (for fauna experts);
  - Human Impact (for eco-police).

### Concluding lesson

- 1 Discuss the following issues with the class using the results obtained from the outdoor studies:
  - Which factors determine and regulate biodiversity?  
(*availability of food, water, oxygen, appropriate habitat*)
  - Describe the biological diversity of a grassland ecosystems. Have the students list the names of other plants and animals they know to be inhabitants of meadows. Why are natural grassland communities richer in species than artificial plantations (agricultural lands)?
  - Who/what threatens the biodiversity of grassland ecosystems? Use the information provided in the table on Human Activities and Grassland Biodiversity on page 52.
  - What is the significance of meadow biodiversity to nature and man?
- 2 Write the answers on the board. Organise a brainstorming entitled “What can we do for the protection of meadow and pastureland biodiversity?” Refer to the text at the bottom of page 52.

### Follow-up

- Assign the following tasks:
  - Investigate local endangered and/or rare plants and animals inhabiting grasslands.
  - Make a list of plants of medicinal value growing in the region.
  - Investigate eventual cases of direct or indirect damages caused to grassland communities. Possible sources of information include articles in the local press, experts (ecologists, biologists, etc.), the fire department, journalists and local residents.
- Prepare a “green” information board with the results.





## Pasturelands

Overexploitation is degrading pasturelands. Approximately twice larger than the entire arable land of the world, pastures and meadows feed 1.32 billion heads of cattle and 1.72 billion sheep and goats. The exhaustion of pasturelands results in an increase in the number of artificially fed livestock, which in turn activates the utilisation of arable land on a global scale.

Adapted from *State of the Planet*, 1998, L.R. Brown et al.

## Human Activities and Grassland Biodiversity

Human activity	Steppe	Mountain meadow	Wet meadow
Intensive agriculture	◆	●	■
Pesticide use	◆	●	●
Abandoned land	◆	■	●
Loss of mosaic elements	▲	●	●
Forestation	▲	■	●
Land cultivation	▲	●	●
Agricultural activity	■	●	●
Leisure and tourism	●	●	●
Aboveground facilities	●	●	●
Urbanisation	■	●	●
Drought and irrigation control	●	●	■

Legend:

● negligible impact   ■ small impact   ▲ medium impact   ◆ substantial impact

## Preserving Grassland Habitats

The following guidelines help preserve grassland habitats:

- Avoid the risk of fires, the intensive use of pastures, the mass collection of herbs, and other high impact activities.
- Avoid the use of chemical substances (fertilisers, pesticides, etc.).
- Maintain and restore the elements assuring a mosaic structure of grassland ecosystems (field boundaries, forest belts, small lakes, etc.) that help preserve biodiversity.
- Support the development of non-intensive (organic) agriculture.

"Conservation of natural habitats..." **BirdLife International**, 2002

# Taking Action

## Case 1: Burning

Walking near your home, you notice that agricultural workers are burning the stubble-fields near a forest and meadow. What would you do?

- Stop and explain to them that stubble burning has a bad effect on soil and may ignite a fire in the neighbouring forest or meadow.
- Call the police or fire brigades.
- Call the mayor.
- Get indignant with their careless attitude but do not attempt anything.
- Something else (explain).



## Case 2: Herbs

You meet an herb-gatherer who collects medicinal plants (e.g. the tutsan, whose stems, leaves and flowers are used in the pharmaceutical industry). The man uproots the plants in order to save time and effort. What would you do?

- Explain to him that his method destroys valuable perennial plants.
- Ask him whether he thinks he will be able to collect this herb again in the same place next year.
- Call the police or the mayor of the nearest town.
- Write an article in the local newspaper with guidelines for safe herb-collecting.
- Get indignant with their careless attitude but do not but complain to your friends and family.
- Something else (explain).

## Case 3: Pesticides

You see your neighbour applying a strong pesticide to a potato field infested by the Colorado beetle. The field is located near a natural meadow with beehives. What would you do?



- Explain to him that this method not only exterminates the Colorado beetles but also threatens all insects and other animals in the vicinity.
- Remind him that he is polluting the soil, which may affect the quality of agricultural produce and human health.
- Suggest trying another method of pest control.
- Write an article for the local newspaper describing alternative techniques for controlling pests.
- Do nothing.
- Something else (explain).

## Case 4: Agricultural Land

During the process of agricultural land restitution you receive a track of land — 5 hectares of mountain meadow. What would you do next?

- Sell or lease the land.
- Plough the meadow and transform it into arable land.
- Use it for hay production and/or place some beehives there.
- Build a small outhouse for yourself and use the land for leisure.
- Do not attempt anything and wait for better times to come.
- Something else (explain).



## Important Factors (for ecosystem experts)



A. Compare the environmental factors on both sites studied — the natural meadow and the agricultural land — and fill in the following table.

No.	Ecological factors	Natural meadow	Agricultural land
1.	Light/warmth		
2.	Air movement (wind)		
3.	Moisture		
4.	Nutrient base		
5.	Availability of dwellings		
6.	Other		

B. Take into account the role played by ecological factors in forming and maintaining the biodiversity of grassland ecosystems.

## Grassland Plant Diversity (for flora experts)



A. Investigate the plant diversity by filling in the following table.

No.	Plant species	Exact or approximate number of specimens
	Average number of species	Average number per square metre

**Instructions:**

- Identify plants with a field guide. If you cannot identify a given species, simply record it as grass, bush or tree (but nevertheless write down its characteristics for later identification);
- Mark the investigated sites on a topographic map.
- Photograph particular communities and some characteristic plants.

B. Determine the existence of vegetation floors in the grassland ecosystem.

C. If you have already performed such investigations in other ecosystems, compare the results.



# Grassland Animal Diversity

(for fauna experts)



A. Investigate the biodiversity of animals by filling in the following table.

No.	Animal species	Exact or approximate number of specimens
	Average number of species	Average number per square metre

**Instructions:**

- Use field guides for animals. If you face difficulties in identifying a given species, simply record its presence (but nevertheless write down its typical features for later identification);
- Mark the investigated sites on a topographic map;
- Photograph particular animals.

B. Identify the animals by their sounds. Record some sounds on a tape recorder to help you later identify different species.

C. Search for animal trails. Write down the number of animals and species who made them. Draw the trail contours in life size — this will help you in further identification.

D. If you have already performed such investigations in other ecosystems, compare the results.





# Are We Alone in the Big City?

Authors: Anna Talik, Honorata Waszkiewicz, Tatyana Miteva

<b>Major concept</b>	Animals and plants live everywhere, even in big cities.
<b>Duration</b>	<ul style="list-style-type: none"> <li>• Introductory activity — 2 class periods</li> <li>• Outdoor (on-site) activities — 2-4 class periods</li> <li>• Concluding activities — 2 class periods</li> </ul>
<b>Time of year</b>	Any
<b>Place</b>	<ul style="list-style-type: none"> <li>• Classroom</li> <li>• 4 local — a park, a street with heavy traffic, a housing estate and a residential building</li> </ul>
<b>Materials</b>	Writing and drawing materials, topographic map of the settlement, binoculars, tape recorder, camera, field identification guides for plants and animals, forceps, tape measures, worksheets, self-adhesive tape, carton box
<b>Subjects</b>	Life science, biology, chemistry, sustainable development
<b>Aims</b>	<ul style="list-style-type: none"> <li>• To discover the biological diversity of the big city and to realise the importance of its conservation;</li> <li>• To understand the complex and dynamic relationship between biodiversity and the state of environment;</li> <li>• To develop skills for evaluating the environment and biodiversity.</li> </ul>
<b>Methods</b>	Lecture, discussion, observation, field research, brainstorming, associative game

## Introduction

Human societies have largely suppressed the nature that once existed where cities now stand. Although many plants and animals have disappeared or been driven into new habitats, some organisms have succeeded in adapting to the changed conditions and now co-exist with humans. These organisms have displayed remarkable resourcefulness in their pursuit of shelter, water and food.

## Activities

### Guess the urban species

Organise with the pupils a game of "Who am I?"

- 1 On a sheet of paper write the name of an animal or plant that can be found in the urban environment.
- 2 Ask a volunteer to stand in front of the class and place the sheet on his/her back.
- 3 Have the volunteer ask the class yes-or-no questions and try to guess the name of the animal or plant based on the answers.
- 4 Repeat the game until interest wanes.

### Outdoor (on-site) activity

- 1 Prepare the class for the forthcoming outdoor activities. Introduce the outdoor activity and the fact sheets on pages 59, 60 and 61.



- 2 Divide the class into smaller groups (teams) as follows:
  - urban development experts;
  - biodiversity experts; and
  - eco-policemen.
- 3 Provide the pupils with appropriate instructions, fact sheets, materials, tools and supporting literature (manuals and identification guides).
- 4 Organise field studies at four different sites within the settlement — a city park, a street with intensive traffic, a housing estate and a residential building (the investigations in the latter one can be assigned as the homework in form of the inquiry among the neighbours). It is appropriate to perform the outdoor lessons during various seasons. Apply one and the same methodology in each site, using the fact sheets on:
  - State of the Urban Environment on page 59;
  - State of Urban Biodiversity on page 60; and
  - Biodiversity in the Home on page 61.

### Concluding activity

- 1 Invite the teams to present the results of their field studies. Draw a general conclusion about the state of urban biodiversity, its dependence on the quality of environment and human activity.
- 2 Organise a discussion, brainstorming or small group work on the following issues:
  - Which other animals and plants can be seen in human settlements? Use the additional information given in the text on Synanthropic Plants on page 58.
  - Which factors affect urban biodiversity?
  - Who/what threatens plants and animals in the city?
  - How does urban biodiversity affect (positive and negative) humans? Refer to the text on Urban Greenery. Try to address multiple aspects (e.g. environmental, aesthetic, emotional, moral).
  - Is it possible to create sustainable settlements of the future inhabited by humans only?
- 3 Formulate a moral code for the urban citizen by finishing following sentences:
  - People share the city with...
  - Plants and animals have the right to...
  - Without other living organisms...
  - Future generations have the right to...
  - In order to live in harmony and understanding...



### Follow-up

- Find and investigate cases where the local biodiversity has been harmed. Consult press publications, experts, municipal employees and local residents.
- Investigate “co-existence conflicts” between humans and urban plants or animals such as allergenic plants and trees, stray pets, mosquitoes, cockroaches and ticks. Have them collect data for possible solutions to these problems in your community or elsewhere. Are there any negative consequences from these methods? Is it possible to propose other solutions?
- Offer ideas/projects for a sustainable community foreseeing restoration, conservation and increases of urban biodiversity.
- Use the results obtained from the field research, and the ideas offered to construct a “green” information board in school.



## Synanthropic Plants

Plants undaunted by the company of man always appear close to his lodging or other places changed by human activity. That is why we call them synanthropic plants (after the Greek words *syn* = with and *anthropos* = man). Members of the synanthropic group include many native species that have found suitable habitats, not only in fields and hedges, but also near human settlements. Synanthropic plants are able to conquer any piece of land, even the smallest. From the airports and railway stations they spread across streets and squares located nearby. They “travel” along the rails and river banks, settle in ditches, around fences, in waste disposal sites, gardens and parks. Such places are usually rich in organic compounds, especially in nitrogen-containing substances, and soon become occupied by numerous species that require large quantities of such substances for their development...

With economic progress, the discovery of new lands, the development of waterways and advances in land transport, changes in the primary vegetation spectrum do occur. Many species of the native flora and even whole communities have disappeared as a result of human-caused extermination. New species throng in their place, attacking from all directions. They make use of all forms of transport, sticking to travellers’ shoes, squeezing into travel bags and hooking on to clothes. Together with man, they cross boundless oceans. They also latch onto citrus fruit parcels, bird foos, sowing-seed material, fruits and seeds of oleaginous plants, swine bristles, sheep wool and timber logs.

**Szofia Schwartz, Janina Schober**, *Plant Neighbours of Man*, VS and P, Warsaw)

## Urban greenery

A dirty cloud of eye-irritating dust particles and gases preventing vertical air movement is gathering high (80-90 meters) above large cities, especially on hot summer days.

Calculations suggest that the normal annual dust precipitation per square kilometre is 7.6 tonnes, but in cities the value is much higher. The existing technical solutions and methods applied to clean the air are sometimes inefficient. This is where urban greenery becomes so important. It helps us by producing oxygen, increasing humidity in the air, fixing dust particles onto leaves and absorbing the harmful gases being further transformed into organic compounds necessary for the human population.

A single ten-year old tree (birch or poplar) produces the oxygen needed by one human. However, vegetation dies when dust and harmful emissions occur in heavy concentrations. Sensitivity to air pollution varies and is thus used to gauge the state of urban environment. These plants are referred to as bio-indicators. For example, epiphytic lichens, which grow on trees, are especially sensitive to sulphur dioxide concentrations in the air and therefore tell us about the air quality in a given area.



# State of the Urban Environment

(for urban development experts)



## A. Dust

1. Prepare samples for testing the amount of dust in the air by cutting equal stripes of clear, adhesive tape and fixing them horizontally to sticks or pins with the adhesive side turned up. Place them at different points in the sample area. Each sample should be labelled.
2. Leave the sample strips for one or two hours. Then seal the samples by attaching clean strips of tape of the same type and length to the samples to prevent them from being damaged during transport. Collect them in a box.
3. Place the strips on glass slides with the adhesive side up. Count the number of dust particles seen through a microscope.
4. Move the slide so that a different portion of the strip is showing and repeat the process. Enter the results into the table below:

No.	Studied site	Number of dust particles		
		Sample I	Sample II	Average value
1.	City park			
2.	Street with heavy traffic			
3.	Housing estate — outdoor or common space			
4.	Residential building — classroom or living room			

5. Compare the results obtained and explain any variances in the results.

## B. Noise pollution

1. Track down the sources of noise pollution in the studied sites.
2. Count the number of sources for a period of 10 minutes and determine their types.
3. Evaluate the degree of noise pollution by classifying it as low, medium or high. Enter the results in the table below:

No.	Studied site	Noise sources		Noise pollution (low, medium, high)
		Type	Number	
1.	City park			
2.	Street with heavy traffic			
3.	Housing estate — outdoor or common space			
4.	Residential building — classroom or living room			

5. Prepare a brief conclusion based on the studies of dust and noise pollution in your settlement. Present your statement during the concluding activity.



# State of Urban Biodiversity

(for biodiversity experts)



## A. Urban investigation

1. Investigate the biodiversity at three different sites in your community. Observe the sites directly and approximate the extent to which each species is endangered in urban conditions, as well as the degree of its own impact on the environment. Fill in the following table with the results:

Studied site	Species	Animals and plants						
		Number	Threat of extinction			Impact of the species on the environment		
			Low	Medium	High	Low	Medium	High
City park	...							
	...							
	...							
	...							
Street with heavy traffic	...							
	...							
	...							
	...							
Housing estate — outdoor or common space	...							
	...							
	...							
	...							

2. Look for any injured or dead animals or plants, cut trees or branches, or burned areas. Photograph specific examples.

## B. In the neighbourhood

1. Survey your neighbours about the number of animal species (not only pets) in their homes. Be sure to get a sizeable sample.





# Biodiversity in the Home



A. Which animal species have you seen in or around your home? How many? Where can they be found most frequently?

Animals	Approximate number and/or frequency	Where are they found?

B. What kind of measures do you use against unwanted animals appearing in your home?

- Preventive screens;
- Mechanical killing;
- Chemical substances for direct extermination;
- Chemical repellents;
- Biological enemies (domestic cats or other animals).

C. Evaluation

1. Compare the results obtained. How would you evaluate the biological diversity in your city — non-satisfactory, fair, good or very good? Repeat your research in another season.
2. Prepare a brief conclusion based on your research on biodiversity in your community. Present your statement during the concluding activity.







Urbanisation

Noise

# Threats and Challenges

Waste

Chemicals





## Urbanisation

**Our Community — Past and Present** 65

VIDEOS RELATED TO THIS TOPIC

**Equilibrium**

## Noise

**Noise Everywhere** 70

VIDEOS RELATED TO THIS TOPIC

**Noise**

## Waste

**Materials and Waste** 75

**Waste Management** 82

VIDEOS RELATED TO THIS TOPIC

**Pollution and Waste**

## Chemicals

**Chemicals Around Us** 92

VIDEOS RELATED TO THIS TOPIC

**Living with Toxins**

## Student fact sheets

**On the Trail of Man** 69

**Approaches to Reducing Environmental Noise Pollution** 73

**Different noise levels** 74

**“The Table”** 80

**Which Materials Are Preferable?** 81

**The Vicious Circle** 90

**Composting Site** 91

**Common Products that Contain Hazardous Substances** 95





## Materials and Waste

Authors: Jacek Schindler, Kliment Mindjov

<b>Major concept</b>	Pollution and waste should not be put into the environment faster than the environment can degrade and recycle them, or render them harmless.
<b>Duration</b>	4 independent activities, 1 class period each
<b>Time of year</b>	Any
<b>Place</b>	Classroom
<b>Materials</b>	Green Pack video cassette, various items or packages made of simple and multi-layered materials.
<b>Subjects</b>	Chemistry, biology, physics
<b>Aims</b>	<ul style="list-style-type: none"> <li>To realise the seriousness of waste-related problems;</li> <li>To study the life cycles of different materials;</li> <li>To learn about simple and multi-layer materials used in our everyday life.</li> </ul>
<b>Methods</b>	Lecture, discussion, video presentation

### Introduction

In nature, waste material from an organism usually becomes a meal or resource for another organism. For example, birds will use dead branches or leaves to build their nests; microorganisms and worms in the soil turn leaves and dead animals into humus, which in turn becomes food for plants; and the organic matter in water, such as animal waste or decaying leaves, provides food for aquatic microorganisms.



The enormous amount of energy and resources that society consumes produces so much garbage that the resulting air pollution, water pollution and acid rain have become serious threats to the global environment. Humans have accumulated more waste than they can properly manage, and may soon be drowning it.

In modern society 80 percent of all waste comes from agricultural, industrial or mining activities. The remaining 20 percent comes from households. A large part of what we throw away at home (plastics, metals, paper, glass and organic materials) can be recycled.

## Activities

### Garbage survey

- 1 Present to the class the information from the introduction. Explain that human activities create enormous quantities of solid waste. Negligence and carelessness often cause more add to the problem. Moreover, garbage can spread disease, and it makes the environment unsightly.
- 2 Have the students study the pollution of the schoolyard and its neighbourhood as follows:
  - Give the students paper or plastic bags, and rubber gloves.
  - Have them gather litter in the schoolyard and its neighbourhood for twenty minutes (or more, if necessary).
  - Make one pile of all the materials. Add the rubbish from the wastepaper basket in the classroom and divide the pile into types: paper, metal, glass, plastic waste, organic waste, etc. Weigh them. What is the proportion of the different types of waste?
  - Hold a discussion: who could have thrown away the different kinds of waste?

### Life cycle of materials

- 1 Explain that waste can be better understood by examining the life cycle of its materials that compose, from extraction to final disposal. Materials are transformed into waste as a consequence of various production and consumption processes. Emissions are the residual by-products from these transformation processes that are discharged directly into air and water. Residuals that are further handled before being discharged are referred to as waste.
- 2 Hand out the poem "The Table" by Julian Tuvim on page 80. Read it together and examine the different stages needed to make the table. Add information about stages that are not mentioned in the poem.



- 3 Work out a similar scheme about the desks in the classroom. Most schools are furnished with desks that consist of metal constructions covered with laminated rafts. The rafts are usually made of planks of pressed wood materials (chipboard or particleboard) held together by some kind of glue. Usually the surface of the planks is not painted but covered with laminate, i.e. it is pasted with artificial material, mostly PVC, which makes it look better and lengthens its life-span.

- 4 Show the class the educational film Pollution and Waste included on the video cassette. Discuss it together. Try to answer the following questions:
  - Why is the quantity of accumulated waste constantly increasing?
  - Who helps this to happen?
  - Who, according to the film, can help solve the problems?

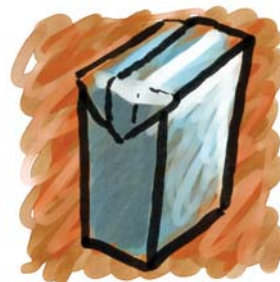


## Which materials are preferable?

- 1 A week prior to the planned lesson, assign the students the task of estimating the quantity of polythene shopping bags that enter their households within one week.
- 2 Calculate the number of polythene shopping bags used in your town or village for one year, using the data given to you by the students, as well as the number of people living there. Try to find out similar information from the shops and use it to compare your calculations.
- 3 Discuss with the students the method of calculation. The large result of the calculation should surprise the students about how many shopping bags are distributed for single usage.
- 4 Ask the students what can be done to lessen this quantity.
- 5 Explain that when we have to choose between objects made of different materials and there is a hesitation about which of them is more environmentally friendly, it is good to remember that, in general, it's best to choose the product made of natural materials. This way of thinking cannot be changed even by the obvious fact our life today is unthinkable without artificial articles. Many objects we use every day can be only made of artificial materials. In many cases artificial articles are preferable to traditional ones, either because they are more hygienic (e.g. syringes) or environmentally friendly. Instead of using simple and false stereotypes, we should estimate not the raw materials themselves, but what they were used for. Refer to the text Waste and ...Waste.
- 6 Hand out the fact sheet on Which Materials are Preferable. Explain the symbols used. Have the class examine which materials (or could be) the objects at the beginning of the fact sheet are made of. In the lower part of the sheet write the names of other objects suggested by the students and allow them to continue the discussions in small groups. The solution of some cases will not be a problem, but others could turn out quite difficult.

## Watch out: Laminates!

- 1 Ask the students to bring different packages of milk: a glass bottle, a plastic bottle; a "carton" (cardboard) box for pasteurised milk (made of foil inside, and outside – of cardboard); a "carton" (cardboard) box with the sign UHT (outside: simple foil, aluminium foil, gray carton, white printing paper, foil made of artificial materials). Analyse the structure of the multi-layer packages. It is easier to see all the layers of the "carton" boxes if you tear them diagonally.
- 2 Begin the lesson by launching a competition between several students to see who is fastest to separate the layers of the "carton" ("cardboard") box with the symbol UHT (for more about this symbol find in the example Simple and Laminated Materials). This is a competition without a winner.
- 3 Explain that more and more often simple materials like wood, metal, paper and plastics are replaced with materials consisting of several different layers. That makes the qualities of the final product better. One example is the desktops mentioned above. When the wooden surface is covered with glue and a layer of artificial material, the result is a top as hard as wood, but as smooth as an artificial material. The case with the UHT boxes for milk is similar. They are made of several layers: cardboard, paper, aluminium foil and foil made of artificial materials. The result is an object with the properties of all these materials: they are as hard as cardboard, opaque like aluminium foil, heat-resistant and impervious to water like a synthetic material, and can be printed on like paper.
- 4 Emphasise that, along with the obvious advantages, there are also some drawbacks. Such multi-layered (laminated) materials, cannot be recycled when they are thrown away as rubbish. They are not recycled because the technology required is expensive and much less profitable than the technologies for recycling simple materials. Introduce to the class the additional information given in the text on Simple and Laminated Materials.

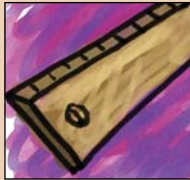


Ask the students to compare the cardboard box for milk with the laminated tops of their desks. Point out the fact that the cardboard boxes for milk and juice are problematic everyday waste because they are widely used, while the share of the desks in the everyday mass of waste is insignificant. In both examples, laminating lengthens the life-span of the object. In the case with the milk the cardboard box ensures its durability and makes it possible to be consumed within 1-2 days. In the case with the school desk, laminating adds years to its life.

## Follow-up

- Assign the students to examine the life cycle of different materials: paper, glass, organic products, different metals and plastics. Encourage them to share their new knowledge with their families at home.

## Waste and... waste



In one class there was a problem evaluating some simple school appliances. The teacher complained that although his students knew that wooden rulers are less harmful to the environment, they still preferred the plastic ones, because they liked them better.

Let's think a little and compare the two types of school appliances. Using wood to make simple appliances like rulers is a choice of product which is not a problem in terms of waste. Even if we do not take care of the wooden ruler and throw it away, it degrades in the environment quickly and harmlessly.

On the other hand, the number of plastic rulers thrown away for a year is so insignificant, that it does not cause any problems in terms of waste. Rulers can be used for years.

Estimating plastic bottles containing different kinds of drinks, however, is a completely different situation. This can be observed in any waste container. Looking for a plastic ruler among the piles of plastic bottles is like looking for a needle in a haystack.

The following argument, which justifies the buying of plastic school appliances, is often used: when we buy rulers, markers and other objects made of plastic, we protect the forests. Such an argument is quite controversial as it presupposes that plastic appears out of nowhere and that oil exploitation does no harm to the environment at all.

Although plastic rulers are not a problem in terms of waste, it does not mean that we should completely forego the use of wood and other natural materials. The fact that in the given examples there is not a big difference in terms of waste does not change the fact that the recommendation of articles made of wood and other materials of plant origin is a significant element of supporting a more environmentally friendly way of living. What we mean here is the formation not only of certain attitudes and beliefs, but also of an aesthetic taste, for which a wooden ruler will be more attractive.





## Paper and Packaging

### UHT

The UHT sign on milk cartons is an abbreviation of the English term “ultra high temperature.” This means that the milk has been packed in the box at a temperature of about 130°C and under pressure. High temperature kills all the micro-organisms that can turn the milk sour. The pressure prevents the penetration of bacteria from outside into the milk and the package. This technology lengthens the lifespan of the milk.

### (Non-)environmentally friendly paper

The term “environmentally friendly paper” is used so often that it is easy to forget which paper is really environmentally friendly (it does not threaten the environment at any stage of its production, usage and recycling). Some of the processes for producing paper are not harmless at all.

### Waste

The waste in paper production is the most harmful “product” of paper mills to the environment.

### Whitening

Paper that has not been bleached is considered “grey.” The whitening process is purely aesthetic. In the past, chloride compounds were used, but today oxygen is used instead (in the form of hydrogen peroxide), which is considerably less harmful to the environment. It is extremely important that paper used for direct packing of food (e.g. wrapping paper for snacks, coffee filters) not be bleached!

### Filling-in, smoothing

Unprocessed paper has a rough, uneven surface. To smooth it, fillers are added to it (e.g. kaolin) and it is rolled. Sometimes, these processes are left out because of the environmental problems they cause, so the paper produced is coarser, with obvious fractures, called “porous” by printers.

### Coating

Coating the paper smoothes the surface. It is favoured by the advertising publishing companies. It is defined as “difficult scrap,” which needs special technologies.

### Polishing

After printing, the paper is polished or even laminated (it is covered with artificial material) as an additional finishing process.

The beautifying processes make the recycling of the paper after its usage impossible.



## The Table Julian Tuwim (1894-1953)

In the forest grew a tree so high,  
That its mighty crown reached the sky.

But the woodcutters fell the forest king,  
It took them a whole day to do the thing.

Their horses had a hard time dragging it down,  
But finally reached the shop in the town.

The shrieking saws gnawed in the flesh  
of the bark,  
They cut and cut — long after dark.

The tree became timber  
and planks good enough,  
To be gladly bought by a man of the craft.

This man was from Warsaw,  
Adam Wishniewsky by name,  
As a master of carpentry he enjoyed great fame.

He measured and cut and hammered with zest,  
Till he made the new table he had no rest.

See how much work, sweat, and time lost,  
Can a simple table cost.

Translation: **Pepa Docheva**



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This man was from Warsaw,  
Adam Wishniewsky by name,  
As a master of carpentry he enjoyed great fame.

He measured and cut and hammered with zest,  
Till he made the new table he had no rest.

See how much work, sweat, and time lost,  
Can a simple table cost.

Translation: **Pepa Docheva**



# Which Materials Are Preferable?

Product	Glass, stone, concrete	Artificial materials (including synthetic fibres)	Metals	Materials of plant origin
soda-pop	<u>Reuseable glass</u> Single usage glass	PET ??	<del>aluminium</del>	0
drinking glass	<u>glass</u>	<del>different glass</del>		0
window	<u>glass</u>	different materials ??	0	0
ruler	0	different materials	<del>aluminium, steel</del>	wood
syringe	glass (+ metal) ??	plastic	<del>steel (+ glass)</del>	0
pesticide bottle	glass	PET	aluminium, steel	0
engine oil bottle	—	PE	—	0
LP record	—	+	0	0
fruit-squeezer	—	+	—	0
bicycle tyre				
camping tin				
shopping bag				
shirt, trousers				
tights				
washbasin				

<u>Underlined name of material</u>	The most suitable of the materials offered in that case.
?? Question marks after the name	A material which has significant drawbacks in that case.
<del>Name is crossed out</del>	A material which is totally inappropriate for this product.
No name given	The choice of material is not important in terms of the impact on the environment.
Name of raw material (+another raw material)	A product containing elements made of different raw materials.
0	Using of this type of material is impossible (e.g. using materials of plant origin to make syringes).
—	It is possible to use this material, but it is not used as there are other more appropriate materials.



# Waste Management

Authors: **Jacek Schindler, Kliment Mindjov**

<b>Major concept</b>	The process of joining the European Union involves some radical changes in attitude towards waste in Central and Eastern Europe.
<b>Duration</b>	5 independent activities, 1 class period each
<b>Time of year</b>	Any
<b>Place</b>	Classroom, a town dumpsite (if feasible)
<b>Materials</b>	Posters
<b>Subjects</b>	Chemistry, biology, physics
<b>Aims</b>	To acquaint students with the principles and methods of waste management
<b>Methods</b>	Lecture, discussion, brainstorming

## Introduction



The dynamic development of industry and the increase of consumption have led to an avalanche of waste disposal. About 80 percent of all waste is a result of agricultural, industrial and mining activities. The remaining 20 percent is home rubbish, a great part of which is reusable (plastic, metal, paper, glass) or biodegradable (organic materials).

Efficient waste management presents an alternative to the ominous prospect of future generations “swimming” in piles of waste.

The European Union has introduced strict laws concerning the methods of waste treatment. Waste cannot be thrown together indiscriminately at dumpsites. If not preliminary processed, the rubbish should be treated in a factory. Only what cannot be recycled should be taken to the dumpsite.

## Activities

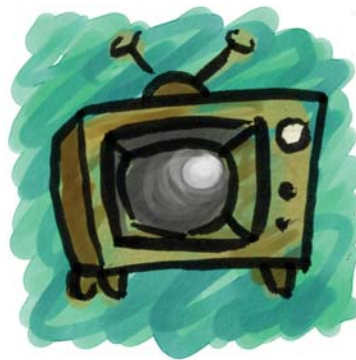
### Principles and ways to treat waste

- 1 Begin the lesson by explaining the vital importance of the problem concerning the exploitation of raw materials and waste disposal. Use the information from the introduction and the Waste chapter of the CD-ROM, as well as the lesson plan on Materials and Waste.
- 2 Introduce the four principles of good waste management using the information from page 89 and support them with appropriate examples.
- 3 Explain that there are several ways to treat waste:
  - restrictions on power and material consumption — by far the most efficient approach, as it leads to a decrease in the quantity of waste generated, and hence, a decrease of means and effort necessary for waste treatment;
  - reuse — it also saves money, apart from all other benefits;
  - separated collection — many valuable materials can be used again, and less power is needed to work with recycled materials than when using raw materials;
  - composting — valuable organic materials are returned to the natural circle;
  - incineration — burning waste uses up its potential energy and decreases its volume (burning in incinerators) — a method, widely used in developed countries, but which has some drawbacks;
  - landfilling — waste is dumped into open holes in the ground, often a quarry.

- 4 Before the lesson, write each of the following terms in block capital letters on a sheet of paper (each term on a separate sheet): waste, rubbish, garbage, waste management, waste dump, laws and regulations, waste treatment, incinerator, separated collection, waste depot, recycling, composting, waste refusal, burning of waste and polluter pays.
- 5 Ask 15 volunteers to come to the front of the class and choose a sheet of paper. Ask them to divide into two groups: the first group for terms connected with our old ideas, and the second group for terms connected with our modern ideas of waste processing. Are there any terms that apply to both groups?
- 6 Ask the volunteers to announce which group they belong to.
- 7 Let the other students also take part in the discussion.

### To be or not to be...

- 1 Introduce the following case to the class: You want to buy a new TV set, although your old one still works. What can you do with the old TV?
- 2 Ask a volunteer to write the suggestions on the board. Here are some typical suggestions.
  - Postpone buying a new TV as long as the old one still works.
  - Give the old TV to somebody who does not have one or cannot afford it.
  - Announce that you are going to give it as a present or sell it for next to nothing.
  - Take the old TV to a second-hand shop.
  - Make a terrarium from the TV box and to take the spare parts to a TV repair-shop.
  - Put a cloth on it and to use it as a small table in front of the new TV.
  - Take the TV to the basement and keep it there "just in case".
  - Take it to another room, so that it could be used simultaneously with the new one.
  - Take it to the waste dump.
- 3 After writing all the suggestions on the board, ask the students to evaluate them according to the following criteria:
  - Are you going to prevent waste disposal by restricting consumption (the decision not to buy a new object)? — 1 point;
  - Are you going to prevent waste disposal by trying to lengthen the lifespan of the object you don't need any more? — 2-4 points;
  - Can you find a new application for the object? — 5-6 points;
  - Does the unnecessary object contribute to the increase of consumption (more time spent in front of the TV, making you more dependent on the TV)? — 7-8 points; and
  - Do you think of the old TV as waste? — 9-10 points if your answer is "yes."



The best suggestions are those which have the fewest number of points.

- 4 Draw your students' attention to two more criteria (without giving them points).
 

Are the suggestions realisable within the local circumstances (for example, is there a place nearby where you can sell old TV sets)?

Is the idea innovative? Here you could point out any abstract, non-traditional ideas that are also interesting and creative.
- 5 In the end, prioritise the suggestions according to their environmental friendliness, realism and originality. Think of other similar cases to introduce to the class.





### Organic waste — a gift to nature

**1** Introduce the following case to the class: Trimming fruit trees or pruning vines results in a lot of organic waste. What can we do with it?

**2** Ask a volunteer to write suggestions on the board. Here are some typical practical suggestions. Organic waste can be:

- transported to a remote place, where it will not disturb anybody (e.g. deep in a forest);
- transported to a waste dump;
- cut into pieces and used for mulching (i.e. covering the ground with wet straw, natural fertiliser, peat or special paper to retain moisture and to protect the soil from drought or freezing);
- cut into pieces, packed, put into bags and sold as mulch;
- cut into pieces and composted;
- sold to a lumber-processing factory for producing chipboard or particleboard;
- sold to a factory to be processed into pulp and used for making packages (e.g. cartons for eggs); or
- dried up and burned as firewood for heating.

**3** After writing all the ideas on the board, ask the students to evaluate them according to the following criteria. How is the waste treated: as rubbish (1-2 points), as biodegradable material (3-5 points) or as industrial material (6-8 points)?

The best suggestions are the ones with the most points. Point out two other criteria (without giving them points):

- Are the suggestions realisable within the local circumstances (e.g. if the students have taken into consideration a factory in the vicinity, which uses wood waste, or a shop selling mulch, compost, etc.)?
- Is the idea innovative? Here you could point out the abstract, non-traditional ideas that are also interesting and creative.



- 4 In the end, prioritise the suggestions according to their environmental friendliness, realism and originality. Think of other similar cases to introduce to the class.

Explain that organic waste is a considerable part of home rubbish. It is important from the point of view of further processing — mainly through composting. Correct composting does not have a negative impact on the environment; on the contrary, it gives back to nature extremely valuable organic material that would be otherwise left at the waste dump. The quality of compost depends on preliminary sorting of the scrap. If organic substances are put in the same container with other waste, they become useless. On one hand, they cannot be used for gardening, as they would be mixed with broken glass or toxins. On the other hand, the quality of the rest of the waste, which could be used as scrap, will deteriorate.

Introduce to the class the ways of preparing compost, by using the Composting Site fact sheet. Encourage the students who live in houses with gardens to organise composting of the organic waste thrown away by their families.

### Waste in our town or village

- 1 Send several students to the local waste management company, invite one of their officials to visit your class or meet them at the waste department. Interview an official from the local cleaning company about waste management.



- 2 Talk about how waste is treated in your region. Discuss the following questions:
- Are the costs associated with transporting the waste paid for?
  - Does the fee depend on the quantity of the waste?
  - Are recyclable contents collected separately? If so, do these costs influence the transport fees?
  - Are there any “illegal” waste dumps?

- 3 Acquaint the students with the case of A Town Called Careless on page 88. Compare it with the situation in your town or village. Discuss if your established system is efficient. Does it stimulate the citizens to lessen the quantity of waste generated? How can this system be improved?

Work out some suggestions for improving waste management in your region. Write them on the board. Choose a few students to write a letter to the municipal company on behalf of the class.

### Burning or Incineration

Explain that many people consider burning or incineration an efficient solution to the waste problem. Here are some of the most common points in favour of incineration:

- At home, rubbish is burned in order not to pay for its transport. Besides, burning rubbish in the stove helps to heat the house in winter.
- Burning industrial waste in the factories “saves” them from paying for processing.
- Burning straw in the field eliminates the problem of gathering and transporting it.



### A cigarette box

- 1 During the break before the lesson, take an ashtray with a few cigarette butts from the staff room. Ask a teacher who uses a plastic cigarette filter to lend it to you. (It is possible to find some other device for filtering the cigarette smoke — some of them even use water in the filtering process. For the lesson you will also need a box of filter cigarettes.
- 2 Suppose that this cigarette box is a piece of waste that has been disposed of. Of course, nobody throws away unsmoked cigarettes, not to mention a full pack of them. But in our case the throwing away of the full box is a good example, as it is made of different materials (paper, cellophane, tinfoil, and tobacco), of various components and similar to the rubbish we throw away at home.
- 3 “Dissect” the box of cigarettes. Divide it into its component materials. Ask the students what can be done with them. They should know that the paper and the cardboard could be sent for recycling; the cellophane and the tinfoil can be recycled; the tobacco can be composted. What is left are the cigarette filters, which nowadays are made of acetate fibre. If nobody can work out how they can be used, they should be taken to the waste depot.
- 4 Now, imagine that in your region there is a furnace for burning home rubbish, so you do not have any problems with their management, as they are going to be burned. By analysing the content of the ashtray, the plastic filter or any other filtering device, and by evaluating the quality of the air in the smoking room, draw your students’ attention to the pollution caused by the process of waste burning.
- 5 Work out the difference between home rubbish and the rubbish resulting from the “dissection” of the box of cigarettes. Point out that the unprocessed scraps we throw away at home contain a lot of water. To burn them we need a lot of energy, because: firstly, this water should be removed, and secondly, the waste itself should be burned (i.e. its heterogeneous mass) at different temperatures.



### The vicious circle

- 1 Give as an example a village or town that incinerates its waste. Prior to the lesson, ask six volunteers to acquaint themselves with the points of view of a citizen, a contractor, a worker, a neighbour, a farmer and a fire-fighter.
- 2 Brainstorm arguments for and against incineration and write them on the board. These could be:
 

**Arguments “FOR” burning:**

  - Burning the waste will decrease its quantity.
  - Reducing waste to ashes decreases greatly the mass of the waste transported to the waste dump.
  - Burning is a natural process. In fact, combustion takes place in our bodies as part of its normal functions. Therefore, incineration is a process that does not endanger the environment.
  - Burning home rubbish is a kind of recycling. It differs from the recycling aimed at extracting raw materials in the fact that, through burning, we get energy. This is “energy recycling.”





**Arguments “AGAINST” burning:**

- Burning stubble fields kills animals and microorganisms, the soil becomes less fertile, there is a risk of fires, and if there is a road nearby, there could be an accident. This practice is often a result of ignorance or, at best, a lack of imagination. It would be much more profitable if the stubble field were ploughed and the straw was gathered and used for other purposes.
- By throwing waste containing artificial materials (especially PVC), glues or other chemicals into the stove, or burning it outside, we turn the stove into a reactor producing dangerous chemical compounds, including hazardous dioxins.

The same arguments apply to the burning of industrial waste in factories. These quantities can be limited by applying modern technologies. Waste can also be absorbed or recycled.

- 3 The students will likely reach the conclusion that this method is not at all environmentally friendly. Point out that burning does not destroy the waste. It is instead a process that results in new substances and thus, in new problems.
- 4 Hand out the table showing Emissions and Waste from the Most Common Waste Treatment Processes.

**Follow-up**

1. Look for information and lesson materials about separated collection and recycling of waste — these are available in many new textbooks.
2. Suggest the class draw up a plan for decreasing, reusing and recycling different types of waste. This plan can be published as a model in the school paper or put up as a poster on an appropriate wall in the school.
3. Write about your initiative and ask some journalists to help you publish it in the papers. Announce it through the local radio station.



## Emissions and Waste

Emissions and Waste from the Most Common Waste Burning Processes

Process	Slag (kg/t)	Dust (kg/t)	Products of neutralisation (kg/t)	Waste waters (kg/t)	Gases (m <sup>3</sup> norm.)
Dry	267	22.5	32.5	—	5,280
Semi-dry	295	9.2	41.1	—	4,500
Wet	296	25.0	3.0	500	5,000

**Conclusion:** Burning does not destroy the waste. It even leads to the formation of new substances and thus, to new problems.

## A Town Called Careless

In the town of Careless, a decision was made to destroy illegal waste dumps by providing citizens with efficient means to dispose of their wastes. The town council bought a number of containers, arranged them in a convenient way and signed a contract with the municipal company for servicing the containers. Eliminating the waste pick-up fees encouraged the public to cooperate and dispose of their rubbish properly. The illegal waste dumps disappeared.

After some time it turned out that the quantity of rubbish had exceeded expectations. The citizens were carelessly throwing into the container everything they did not need, even agricultural waste, such as leaves, straw and branches that used to be composted. The town council decided to make the citizens pay taxes commensurate to the containers and dustbins they filled.

After the introduction of taxes, the quantity of the rubbish decreased. It may have been a result of good waste management. On the other hand, though, citizens may have simply burned their excess rubbish. As a solution, a decision was made to put containers for separated collection of recyclables, which the citizens could use free of charge.





## Principles in the Struggle Against Waste



### Prevention principle

It is more efficient to reduce the quantity of waste produced than to improve the methods of their treatment.

Example: Many solid and liquid fuels contain admixtures of sulphur compounds. It would be cheaper and more efficient if the fuels were subjected to desulphurisation (a process of removing the sulphur) in advance, than equipping the power stations, factories and vehicles with devices for absorbing the sulphur dioxide discharged in the burning processes.

### Polluter-pays principle

Those responsible for waste discharge are liable for covering the expenses of the waste treatment.

Example: If, in the vicinity of your town or village, there is a factory generating waste, the expenditures for their treatment should be covered by the polluter and not by the taxpayers.

### Precaution principle

All the possibilities and consequences of generating waste should be well foreseen.

Example: This could be done in the process of making projects and discussing new building projects and activities that may harm the environment by conducting an environmental impact assessment. Citizens have the right to take part in public discussions and express their misgivings.

### Principle of proximity

We should aim at producing goods and providing services in such a way that the biggest quantities of waste are disposed of as closely as possible to the place where the raw materials and energy sources have been extracted.

Example: Extracting raw materials from ores and minerals is best done in the vicinity of the mines/pits, and the waste product should be returned there. Moreover, this will help decrease the transport expenses to manufacturing facilities.



## The Vicious Circle

### The citizen:

I take industrial waste from the nearest furniture factory. I mean, chipboard and plywood. Well, it does smell a bit when I burn it, but I don't pay for the heating. Coke and coal are very expensive, so it's an easy decision.

### The business person:

The tax on transporting waste has been rising for the last few years. By burning the waste I control my expenses.

### The worker:

It's true that the boss burns this plastic litter, but he provides jobs.

### The neighbour:

My neighbour is burning litter containing plastics and glues in his stove. That is absolutely unbearable! We have to close our windows because there is thick smoke coming out of his chimney. But what can we do? He is at his own home and any time I approach him, he tells me not to poke my nose into other people's affairs.

### The villager:

Every year I burn straw in the field and weeds in the ditches. This is a quick and cheap way to get rid of the unnecessary straw and to prevent the spreading of weeds.

### The fire fighter:

Of course, burning stubble fields and weeds in the ditches, as well as burning rubbish at home, is illegal. And we have to prosecute the people who do this, to send the police to them. But I live here. I will not inform against people I meet every day.





## Composting Site

Compost can be made of healthy vegetation scraps, straw, potato peels, leaves, young weeds (without the seeds), turf, food scraps, natural fertiliser, peat, animal waste, wood or peat soot. The quality of the compost depends not only on the ingredients, the proportions and the quality of the raw materials, but also on how it was processed.

Composting organic waste in a rectangular container is the simplest and the most efficient way. When building a construction of planks, net, bricks and other environmentally friendly materials at hand, remember to provide the best possible ventilation for the composted mass.

The composting site should be constructed in a dry shaded place, about 1-1.5 metres wide and as long as needed. After removing the upper soil layer (about 20 centimetres), the ground under the compost should be matted down and then covered with peat, about 20 cm thick. On this pad, which will retain the food substances watered by the compost, are put the composted materials, in 20 cm-thick layers, and each layer is mixed with soil. When the pyramid reaches 1-1.5 metres in height, it is covered with a 10-cm thick layer of soil. A groove is dug along the summit of the prism, and at set times this groove should be filled with water to provide the necessary humidity for the steady degrading of the composted materials. The contents of the compost should be turned several times a year, but not more often than every two months. After mixing, the upper and lower layers become the middle layer. After the last autumn mixing the compost should be covered with leaves or straw to protect it from freezing. The resulting humus will be ready in a year.

Apart from composting in the open air, it can also be done in closed isolated containers. This type uses the natural heat discharged during the fermenting of the compost. The waste, composted by this method, ripens considerably faster.

“Ripe” compost is a homogeneous mass. This fertiliser acts faster than natural humus and plants more easily absorb its contents. It is used in autumn or spring — 20-40 kilograms per square metre of plants.







## Chemicals Around Us

Author: **Kliment Mindjov**

<b>Major concept</b>	Our contemporary lifestyles would be unthinkable without chemicals, but their production and use should be accompanied by constant care and responsibility for the environment and human health.
<b>Duration</b>	2-3 class periods
<b>Time of year</b>	Any
<b>Place</b>	Classroom
<b>Materials</b>	Posters, the Green Pack video cassette, various portable devices using batteries
<b>Subjects</b>	Chemistry, biology, geography, ecology, sustainable development
<b>Aims</b>	<ul style="list-style-type: none"> <li>To explore the various ways in which chemicals affect the environment and human health</li> <li>To learn to store and handle household chemical products safely</li> </ul>
<b>Methods</b>	Lecture, discussion, brainstorming, video presentation

### Introduction

Scientists have identified more than 10 million chemical compounds (natural or man-made). About 100,000 of them are produced commercially, and 200-300 new chemicals enter the market each year.

Estimates show that the current production of chemicals worldwide is about 400 million tonnes. Europe is one of the largest chemical-producing regions in the world, supplying 38 percent of the global turnover.



Chemicals are a subject of concern. A significant number of them find their way into millions of consumer and other products, and from there, into the environment.

Many chemicals are directly released into the environment or discarded after use. Toxic products can be found in air, water, soil, the biosphere and the food we eat.

## Activities

### What do we know?

- 1 Introduce the information about the chemicals people use nowadays, referring to the text in the introduction and the Chemicals section of the CD-ROM.
- 2 Start a brainstorm on what types of chemical substances are among the most frequently used industrial products (medicine and other pharmaceuticals, cosmetics, plastics, soap, detergents, synthetic fertilisers and agricultural chemicals, synthetic fibres, synthetic rubber, paints, etc.). Put the answers on the board.
- 3 Use the information from the CD-ROM to add some figures and data to make the picture more complete. Emphasise the fact that contemporary life is unthinkable without chemicals. Explain to the class that, besides their indisputable advantages, a lot of chemicals have an essential disadvantage — their negative effect on the environment and people's health.

### Batteries: positives and negatives

- 1 Ask the students to bring in various portable devices (radios, electronic games, CD-player, torches, etc.).
- 2 Warm up the class with the following questions:
  - What time is it? Is your watch mechanical or does it work on batteries? What is the proportion between the two types?
  - From what source does all portable machinery receive energy?
- 3 Explain that batteries are broadly used as energy sources and can become dangerous to human health and the environment. While they are still in use, they are not a problem, but once they are exhausted and thrown away, they become dangerous. Certain batteries contain heavy metals that can damage human health even in tiny concentrations. These are cadmium, lead, mercury, and others. When batteries are discarded their metal cover degrades and they corrode, releasing heavy metals into the environment. The water that soaks through the soil when it rains can transport these metals to rivers and lakes or to underground waters used in households. One of the most dangerous metals — mercury — can enter the body directly, through drinking water, or indirectly, by accumulating in animals or plants used by humans for food.
- 4 Ask students what their parents do with old car-batteries. Which battery elements are harmful to the environment (acid, lead, and plastics)?
- 5 Look at some of the batteries brought by students and brainstorm: "Where do we use batteries in everyday life?" Write the answers down on the blackboard or on a poster.
- 6 Explain when batteries become dangerous. Citizens should be aware that the most commonly used products contain hazardous substances.





7 Brainstorm on what students could do to solve the problem of harmful batteries. Write the answers on the board or a poster.

Some of the answers might be:

- Use batteries that can be re-charged many times. Thus, fewer batteries will be used and discarded.
- Collect all old batteries in a container, then bring them to a specialised company for further treatment.

Explain to the class that if there are no such companies in your area, the students could start an initiative (at least within their municipality) for collecting dangerous batteries and storing them.

### Chemicals in the home

Introduce various household chemical products that families use every day.

#### Variant 1

Use the interactive section Chemicals in the Home of the CD-ROM to initiate a discussion. Try to think which of the dangerous chemicals could be stored in special places together with old batteries.

Focus on the following questions:

- Which of the chemicals are the most common?
- In what ways are chemicals dangerous to human health and the environment?
- What preventive measures could be taken?



#### Variant 2

1 Show the video Living with Toxins.

2 Ask the students to discuss the three parts of the video in the correct order.

- chemicals found in the garage;
- chemicals used in cosmetics; and
- chemicals found in the home.

3 Pose the following questions to begin a class discussion:

- Which chemicals are the most common?
- In what ways are chemicals dangerous to human health and environment?
- What preventive measures could be taken?

### Follow-up

- Organise a meeting with local council members or representatives of a regional or other environmental inspectorate.
- Tell them about your initiative to collect old batteries and ask them to determine a specific place within the region for their storage/treatment.
- Write about the initiative and approach journalists to help spread the word through the press. Also try a local radio station.



# Common Products that Contain Hazardous Substances



Some **plastics** contain organochlorine compounds and organic solvents.



Most **pesticides** contain organochlorine and organophosphate compounds.



Some **medicines** contain organic solvents and residuals, as well as traces of heavy metals.



Many **paints** contain heavy metals, pigments, solvents and organic residues.



**Batteries** contain heavy metals.



**Gasoline and other petroleum products** contain oil, phenols and other organic compounds, heavy metals, ammonia and acids.



Many **metal products** contain heavy metals, pigments, oils and phenols.



**Leather** may contain heavy metals.



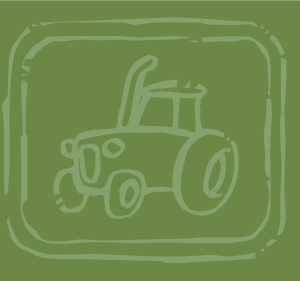
Some **textiles** contain heavy metals.



What kind of chemicals and hazardous products can be found at home?

No.	Chemical/product	What is it used for?





Energy

Transport

Industry

## Human Activities

Agriculture

Forestry

Tourism





## Energy

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VIDEOS RELATED TO THIS TOPIC

**Commercial Forms of Energy**  
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## Transport

**People and Automobiles** 107  
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**Means of Transport, Energy and Environment**  
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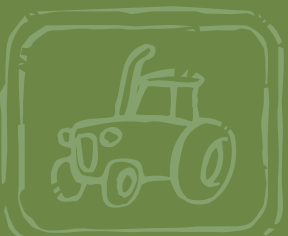


## Industry

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## Agriculture

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## Forestry

**Oh, My Forest! Oh, My Beauty!** 131

VIDEOS RELATED TO THIS TOPIC

**Cutting Trees**  
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## Oh, My Forest! Oh, My Beauty!

Author: Kliment Mindjov

<b>Major concept</b>	Because forests serve many important functions for the environment and man, society should take special care to preserve and manage them.
<b>Duration</b>	3 class periods
<b>Time of year</b>	Any
<b>Place</b>	Classroom
<b>Materials</b>	Posters, Green Pack video cassette
<b>Subjects</b>	Biology, geography, ecology, sustainable development
<b>Aims</b>	<ul style="list-style-type: none"> <li>To enrich students' knowledge of the functions and importance of forests</li> <li>To draw students' attention to the dangers to the environment caused by exploiting forests for economic purposes and relaxation</li> </ul>
<b>Methods</b>	Lectures, discussion, brainstorming, video presentation

### Introduction

Forests serve many functions. Primarily, they protect and form natural resources. Through the processes of photosynthesis, forests renew the oxygen supply in the atmosphere by absorbing atmospheric carbon dioxide and moderating the greenhouse effect. Forests provide an environment for many species of plants and animals, thus protecting and sustaining the diversity of nature. Forests clean the environment by muffling noises, buffering strong winds and trapping dust and gases. They help regulate surface water runoff, moderate high and low temperatures and prevent soil erosion. In performing these functions, forests stabilise the climate and shape the landscape. Forests are also popular areas for relaxation and recreation.





## Activities

### What is a tree used for?

- 1 Ask the students to draw a tree with a well-developed crown on the board. Ask them to then draw its underground root system.
- 2 Answer the following questions as a group:
  - What do trees provide us with? (*fruit, nuts, honey, butter, medicine, etc.*)
  - What are trees used for? (*building material, firewood, making tool handles, animal habitat, cultural and ritual ceremonies of some tribes, etc.*)
  - What else haven't we thought about? (*they provide a place for rest or shelter, in autumn the leaves fall and turn into soil*)
- 3 Remind the students that:
  - Through the process of photosynthesis, green plants absorb carbon dioxide and supply us with the oxygen we breathe. Fewer trees will mean more carbon dioxide in the atmosphere and an increase of the greenhouse effect.
  - Through their root system, trees, undergrowth and grass protect the soil from erosion and prevent the encroachment of deserts.
  - Plants soak up precipitation, thus preventing floods.
  - Their roots retain water and alimentary substances, thus preventing soil erosion.
  - The presence of vegetation determines the humidity of a region.
- 4 In conclusion, point out that the preservation and enlargement of green areas is the most effective way to prevent desertification and erosion. It also slows climate change.

### Forests and industrial activity

- 1 Explain that forests provide huge income in lumber for housing, biomass for wood fuel, pulp for paper, ingredients for medicines and many other products. Many forestlands are also used for mining, grazing and livestock.

Worldwide, about half the timber cut each year is used as fuel for heating and cooking, especially in less developed countries. Some of this fuel is burned directly as firewood, and some is converted into charcoal, which is widely used by urban inhabitants and some industries.

One-third of the world's annual timber harvest consists of logs to be converted into building materials, such as lumber, plywood, hardboard, particleboard and chipboard. One-sixth is converted into pulp used in a variety of paper products.



- 2 Show the Green Pack video cassette's Cutting Trees clip.
- 3 Discuss the film in the context of illegal lumbering. Ask the students for similar cases they have witnessed or learned about from the media. Help the students see that although the unsustainable exploitation of the forests can bring quick profit today, it will destroy the opportunity for steady income in the future.

- 4 Discuss and write on the board what other losses people would suffer as a result of the unreasonable attitude towards forests (*increased soil erosion, loss of beauty to the countryside, loss of tourism, negative impact on forest biodiversity, etc.*) Consult the Forestry chapter on the CD-ROM for more information.
- 5 Show the class the video clip Recycling and discuss the importance of wood-pulp for paper production.

### Forests and recreation

- 1 Explain that the importance of forests as a source of recreation has gained increasing attention in Europe during the past two decades. Forests provide many of the non-material benefits needed by people, especially those living in the stressful environments of modern industrialised countries.

The impact of recreational activities has been to both the benefit and detriment of forests. In general they tend to favour, and thus preserve, forests with high levels of biodiversity, encouraging the conservation and protection of wildlife and helping to limit the loss of forest to urban sprawl and road building.

However, when the frequency of visitors and tourists becomes excessive, problems of soil erosion occur along footpaths. Wildlife is also disturbed, plants and saplings are trampled, and litter accumulates.

- 2 Go for an imaginary walk in some of the most famous mountain areas in your country. List their names on the board and record: their characteristic features; effects on the forest ecosystems from lumbering, tourism, winter sports, livestock grazing, house and road building, etc.
- 3 Hold a brainstorming session on the harm caused to the environment while walking in the forest. Write the answers on the board.
- 4 Hand out the worksheet While Walking in the Forest.

### Follow-up

- Hold a competition for the best poster showing the role of the trees. Organise an exhibition for the best posters.



# While Walking in the Forest

While walking in the forest you should follow simple guidelines to minimise your environmental impact.

---



- Follow established trails in small groups.
  - Avoid fragile areas, particularly wetlands and unstable slopes.
- 



- Stop to rest only in areas where your presence will not damage vegetation.
- 



- Camp only in appropriate areas, preferably in established campsites.
- 



- Learn about indigenous animals and avoid disturbing them.
  - Do not continue to approach animals after they become aware of your presence.
  - Let animals eat their natural foods. Giving them human food can disturb their diets and behaviour.
- 



- Use fire responsibly.
  - Burn your fire down to white ash and let it cool completely.
- 



- Do all washing at least 100 metres from the nearest water source.
  - Minimise the use of soap.
- 



- Dispose of waste and wastewater properly.
  - Take your garbage home.
- 



- Refrain from picking flowers.
- 







## Tourist Invasion

Authors: Anna Schindler, Kliment Mindjov

<b>Major concept</b>	Tourists who fail to restrict their activities may end up destroying the very nature they have come to see.
<b>Duration</b>	<ul style="list-style-type: none"> <li>• Several teaching periods, depending on the aims of the excursion;</li> <li>• 1 class period in the classroom</li> </ul>
<b>Time of year</b>	A day of fine weather, any season
<b>Place</b>	The mountains, woods or a park; the classroom
<b>Materials</b>	Plastic bags, sheets of paper, camera, newspaper clippings and tourist agencies' advertising brochures, the Green Pack video cassette
<b>Subjects</b>	Geography, biology
<b>Aims</b>	<ul style="list-style-type: none"> <li>• To learn about the harm that tourism can inflict on the environment</li> <li>• To learn to tread lightly on the environment during an excursion into nature</li> </ul>
<b>Methods</b>	Excursion, observation, discussion

### Introduction

Tourist destinations are usually concentrated in or near mountains or bodies of water, or in towns of historical significance. A range of hotels, guest houses, restaurants, cafes and souvenir shops form a genuine tourist infrastructure in these places. This development, as a whole, leads to the degradation of the natural environment in mountain and seaside regions, and in many ways resembles the destruction we observe in the towns and cities.



Mass tourism increases the demand for electrical power, water, consumer products and services, facilities like airports, roads and car parks, and an elaborate network of tourist destinations. The result of this growth is the rising rates of dangerous substances, noise, and environmental degradation. Because of these features, mass tourism is considered to be aggressive tourism, and phrases like: "invasion" or "hordes' invasion," which are commonly used in everyday speech, reflect the atmosphere, that dominates during the holiday season of a popular resort.

Refer to the Tourism chapter of the CD-ROM for additional information.

## Activities

### Walk

- 1 Organise a walk to a village in the vicinity. Explain to the students that relaxing in nature is an important part of many people's lives. Europeans spend considerable time and money on travel. Tourism has therefore become a highly important sector of the economy and a resource for large numbers of people living in tourist regions. Note that many tourists lack a responsible attitude towards the environment, which results in a great deal of harm.
- 2 Pick a blade of grass and crumple a sheet of paper. Throw them both on the ground. Ask the students if acts like these effect the environment.
- 3 Tell the students to spread out in all directions over about 100 metres and find examples of environmental pollution. They should describe the results, and answer these questions:
  - Who is to blame for this kind of pollution?
  - What can be done to prevent it?
- 4 Ask the students to open their backpacks and describe the contents to the others. Ask them what they will not need after the excursion and what they are going to do with it.
- 5 During the excursion ask the students to observe and decide what is the most common litter. Who has dropped it?
  - Have the students pick up all the rubbish they notice along the way.
  - Ask the students what they are going to do with the rubbish they have picked up. Would they dump it in their garbage cans in front of their own homes? Tell them that this is exactly what the young people in many European countries do.
- 6 During the excursion ask the students to observe the state of the region and the level of its pollution. They could take photos or draw pictures of the most striking examples.
- 7 Ask them to start a discussion based on their observations and organise an exhibit. Discuss the possibility of putting informative notices at the starting points of tourist destinations with information about interesting natural sites, means of public transport, as well as shops, restaurants and other items of interest to tourists.
- 8 Show the students some of the most serious dangers to protected territories using the information in Footprints on page 138. Brainstorm some possible solutions.



### Mass, international and country tourism

- 1 One week in advance, ask the students to find tourist ads in the newspapers — advertising travel to well known resorts in the country or abroad.
- 2 During the lesson, analyse the brochures the students have collected. Note what the students consider to be a tourist attraction. Are these attractions connected with the natural features of the precise regions or do they represent the mass standard, defined by a particular number of stars pertaining to the hotel's comforts and dining quality? Note any variety, if any, between these brochures.
- 3 Hand out the Comparison Between Mass and Country Tourism fact sheet and ask them to add their own observations.
- 4 Start a brainstorming session on the following topics:
  - What is the effect of mass tourism on the environment?
  - What is to be done in order to encourage mass tourism that has less affect on the environment?

### Weekend

View the video clip Weekend with the class, which is on the video cassette. Discuss its content and formulate the main messages of the film.

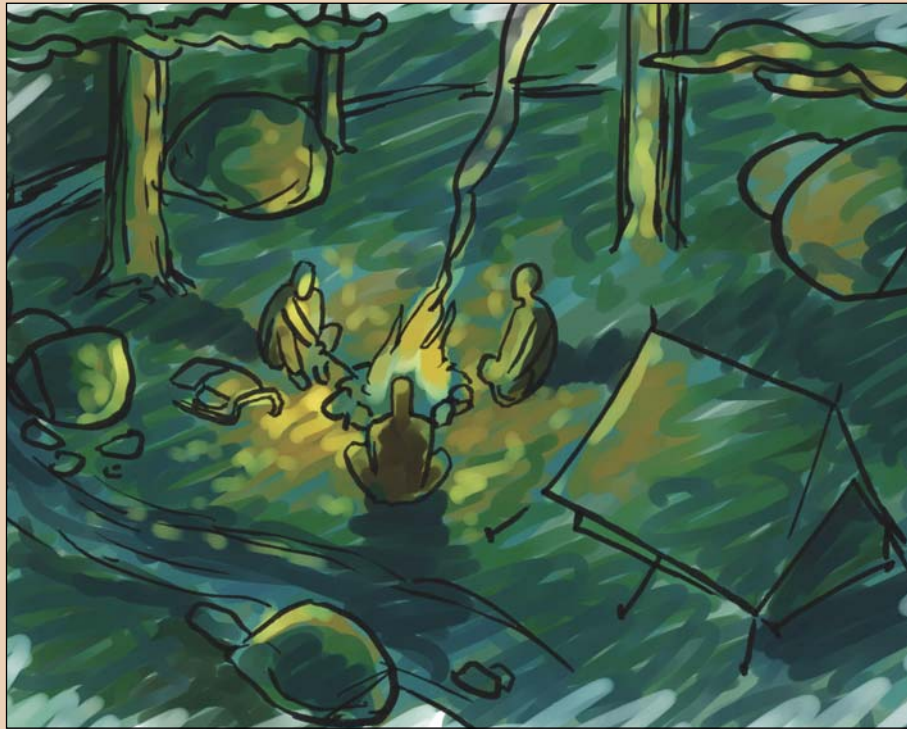
### Follow-up

- Publish a newsletter or brochure with texts, photographs and drawings that express the messages the class has learned during the lesson.





## Footprints



### Dangers facing protected areas

Nature and national parks are endangered by the rising number of visitors, the demands related to resting in the open air and the growth of holiday facilities. The number of tourists soars at the height of the season (usually July and August).

Most visitors to protected areas come by car for a day. As a result, there are parking problems, kilometres of traffic jams and a spike in pollution.

Wild nature attracts tourists. This disturbs the wildlife (lack of peaceful places to raise their young) and leads to a decrease of animal species.

Another serious problem is the erosion taking place in tourist destinations and the destruction of plant growth as a result of hiking and mountain biking.

### Tourist industry facts and figures

Every year over 500 million people travel abroad on holiday, which makes about 8 percent of the Earth's population.

Nearly 7 percent of the population is employed in the tourism sector.

Tourism creates about 6 percent of the world's gross revenue.

### Benidormisation

This term applies to the pathological commercialisation of peaceful, secluded areas noted for their significant natural and climatic features. The name comes from the Spanish fishing village Benidorm in the province of Alicante, situated along the Costa Blanca bay of the Mediterranean. The demands of mass tourism have turned this place into a monster of an urban resort with high-rise hotels, a shopping mall, bars, discotheques, fast food stalls and absurdly crammed beaches.

**Władysław Kopalinski**, *Słownik Wydarzeń i pojęć XX wieku*

(Dictionary of Events and Terms of the 20th Century), Wydawnictwo Naukowe PWN, Warsaw 1999

# Comparing Mass and Rural Tourism

## MASS TOURISM

## RURAL TOURISM

### Journey to a holiday place



- From several hundreds to several thousands of kilometres. In most cases several dozens of kilometres.
- Transport: airplane, car, train

- Travel by car or public transport

### Accommodation



- In most cases, air-conditioned hotels out of town
- Expensive

- Country house accommodation
- Less expensive

### Food



- Food is transported to the holiday place from distant regions

- Part of the food is produced locally, very often according to the principles of ecological farming

### Tourist destinations



- Standard area according to the mandatory urban norms. The most valuable areas in terms of nature are ruined by the infrastructure that allows an enormous number of people to stay in one place and participate in active pursuits that destroy ecosystems (e.g. skiing, aquatic motor sports).

- Natural rural environment with a unique ecological and social character of the village

### Ways of spending leisure time



- Varies according to location

- Rest, cycling, riding, mushroom gathering, farming activities...

### Organiser



- Hotels and facilities are mostly owned by large corporations. The participation of local populations in the profits is limited. Travel agencies, too, are supported by mass tourism.

- The investor and owner of the tourist unit is the landlord. There is no profit leakage out of the particular region.

### Contacts with local people



- Tourists are treated as clients

- Tourists are treated as guests

### Informative advantages



- Closer acquaintance with nature and local customs and habits











Climate Change

Ozone Depletion

**Global Challenges**

Acidification

Seas and Oceans







## Acid Rain

Author: **Kliment Mindjov**

<b>Major concept</b>	Acidification is a serious ecological challenge to modern society that can be counteracted in a variety of ways.
<b>Duration</b>	2 class periods
<b>Time of year</b>	Any
<b>Place</b>	Classroom
<b>Materials</b>	Posters, the Green Pack video cassette
<b>Subjects</b>	Chemistry, biology, physics, sustainable development
<b>Aims</b>	<ul style="list-style-type: none"> <li>To give more information about the character and reasons for acidification of the environment</li> <li>To raise awareness of measures to reduce acidification</li> </ul>
<b>Methods</b>	Lecture, discussion, brainstorming, video presentation

### Introduction

Air pollution refers to the presence of chemicals in the atmosphere in quantities and duration that are harmful to human health and the environment.

In modern industrialised countries, air pollution is due to three main groups of pollutants: carbon dioxide, sulphur oxides and nitrogen oxides.

As clean air moves across the Earth's surface it collects primary pollutants such as dust (caused mostly by storms and volcanic eruptions) and emissions from human activities (cars, industrial production, power generation, etc.). Primary pollutants often mix with the churning air and react with one another or with the basic components of air (oxygen, nitrogen, water vapour, etc.) to form new pollutants, called secondary pollutants. One of the most typical examples is acid rain.



### Activities

#### More about acidification

1 Explain that acidic substances, like sulphur- and nitrogen oxides, can stay in the air for days and can be moved vast distances (sometimes thousands of kilometres). Meanwhile they react with moisture in the air, forming acids (sulphur and nitrogen). Irrespective of whether they are in the form of acid or powder, they eventually reach the ground and change the chemical composition of soil and water.

The existence of nitrogen, which is a product of natural fertilisers, has the same effect on soil and water. This process has an impact on ecosystems and leads to acidification.

Dying forests in Central and Eastern Europe, along with the existence of many dead lakes in Scandinavia and the Alps, can be directly attributed to acidification. At the end of the 1970s, acidification was acknowledged as a phenomenon that seriously threatened the environment. As a result, many research programmes aimed at studying the whole process were launched.

2 Show the educational film Acid Rains included on the video cassette. Ask the following questions:

- What are the consequences of acid rain? (*Poisoning the water in freshwater basins, destruction of buildings, etc.*) Use further information from the text on More about Acidification.
- What causes acid rain? (*Sulphur- and nitrogen oxides emitted by traffic, industry and power production.*)
- Why is it necessary to limit acidification? (*Protection of human and animal health, cultural monuments, buildings, metal constructions, etc.*)

#### How to overcome the problem

1 Explain that active measures should be taken to limit acid pollutants from cars, air transport, power production, industrial activity and intensive agriculture. Spreading information about this would help change habits and lead to more efficient use of energy and industrial capacity. It would also help introduce a more sustainable approach in agriculture.

2 Hand out the fact sheet What Society Can Do.

3 Hold a brainstorming session on what can be done to stop acidification. Write the answers on the board.

### Follow-up

1. Illustrate the formation of acid rain and its impact on different components of the environment and human health by showing the interactive illustration on acid rain included in the CD-ROM.
2. Ask the students to investigate their town or village and the vicinity, looking for evidence of harm caused by acidification (damaged trees, buildings, cultural monuments, metal constructions, etc.).
3. Encourage the students to discuss what they have learned and observed with their parents.





## What Society Can Do

The following measures will help curb the occurrence of acid rain:



- Using ammonium fertilisers rationally and storing them with care



- Promoting and developing electric and hybrid vehicles to reduce emissions
- Using natural gas rather than solid fuel



- Improving insulation in buildings and equipment



- Widening the use of regenerating energy sources — solar, wind, water, biomass, geothermal springs, tides, etc.



- Installing catalytic converters on motor vehicles and equipping industrial enterprises and thermal power stations with purification systems to decrease atmospheric pollution
- Removing all sulphur from fuel before use



- Promoting energy-saving technologies and public transport
- Enforcing strict regulations on transport means



- Showing preference for rail or water transport over road traffic



- Encouraging the use of bicycles for short and medium distances in urban areas



- Imposing emissions limits on aircraft at the international level (fossil fuel burned by aircrafts introduces significant quantities of nitrogen oxides and sulphur dioxide into the upper atmosphere)





## Saving the Black Sea

Author: Kliment Mindjov

<b>Major concept</b>	“The very survival of the human species depends upon the maintenance of the oceans clean and alive, spreading all around the world. The ocean is our planet’s life belt.” - Jacques Cousteau
<b>Duration</b>	2-3 class periods
<b>Time of year</b>	Any
<b>Place</b>	Classroom
<b>Materials</b>	Posters, Green Pack video cassette
<b>Subjects</b>	Geography, biology, chemistry, environment protection, sustainable development
<b>Aims</b>	<ul style="list-style-type: none"> <li>To learn about environmental threats to seas and oceans</li> <li>To discuss the difficult ecological situation of the Black Sea and stress the need for international cooperation on its behalf</li> </ul>
<b>Methods</b>	Lecture, discussion, brainstorming, role-playing, video presentation

### Introduction

Water in the oceans is in constant motion due to solar heat, the Earth’s rotation and the gravitational pulls of the moon and sun. Ocean currents mix the warm water from the tropics with the icy water of the polar seas. The mixing of warm and cold water is important to the Earth’s climate, the life sustaining systems of the oceans, and the world’s fish stock. The interaction of the atmosphere with the oceans and seas has great impact on the climate and weather. Oceans help to decrease the greenhouse effect by absorbing enormous quantity of gases, especially carbon dioxide.



Annually, oceans produce about 200 billion tonnes of plankton, mainly in coastal regions. Plankton is an essential link in the food chain, feeding between 200 and 400 million tonnes of fish annually.

The non-living elements of the oceans are also important. Seawater and the seabed are abundant in minerals. Salt water can be distilled and used as drinking water.

For thousands of years people have used the seas for fishing, transport and commerce. They now also extract petrol, gas and minerals from coastal waters. Unfortunately, the oceans have also become dump sites for human wastes, including sewage, household rubbish and hazardous by-products like nuclear waste.

## Activities

### Information on the Black Sea

- 1 Introduce the topic with information from the introduction and the Seas and Oceans chapter of the CD-ROM about the general role of seas and oceans.
- 2 Explain that the Black Sea is part of the greater oceanic system of the world, but due to its nearly complete isolation it has specific ecological problems. Ask three volunteers to act as experts on the Black Sea. Hand them the Black Sea Fact Sheet and have them present the information to the class. Assign a separate section to each of them.
- 3 After the presentations, point out that the ecological condition of the Black Sea cannot be completely rectified by one single country. Rather, joint efforts are needed by the governments and individuals who affect it.

### Classroom conference on the Black Sea

#### Conference preparation

- 1 Students will participate in an international conference: Let's Save the Black Sea. Discuss if it is necessary to invite representatives of:
  - countries sharing the Black Sea coast;
  - countries, contributing to its pollution — the ones situated along the Danube River — Germany, Austria, Slovakia, the Czech Republic, Hungary, Croatia, Serbia and Montenegro, and Moldova;
  - European and world organisations dealing with environment conservation, migratory birds, etc; and
  - companies dealing with sea transport, tourism, fertilisers and oil production, etc.
- 2 Write on the board the names of all the representatives that should be invited.
- 3 Ask the students to select volunteers to play the role of these representatives and defend their view points and interests. You must include in the invitation the three experts, as well as representatives of NGOs defending the interests of conservationists, fishermen, small hotels and restaurants, and others of relevance.

#### First round of discussions

- 1 Arrange the desks in a circle to suggest that all participants will be given equal opportunities to participate.
- 2 Draw three parallel columns on the board and ask one or two volunteers to act as secretaries who will record the main points from the participants.
- 3 Pose the following questions as departure points for the first part of the conference:
  - What are the specific features of the Black Sea?  
(use the information provided by the experts.)



- What is the Black Sea used for? (*transport, fishing, extraction of salt, sand and oil, tourism and recreation, waste deposits, etc.*)
- What are the sources and forms of pollution to the Black Sea? (*oil products, heavy metals, different chemical pollutants, pesticides, nutrient substances and waste from towns and villages, harbour activity, industrial factories, transport of people and goods, etc.*). Remember to discuss how rivers flowing into the sea contribute to the pollution.
- What other specific activities can endanger the biodiversity of the Black Sea? (*overfishing, use of some illegal methods – trawling, introduction of unknown species, draining of damp coastal zones, etc.*)

Ask the secretaries to write this part of the information in the first column.

### Second round of discussions

- 1 Move to the second part of the conference by writing countermeasures that could be taken to alleviate the problems listed in the second column. Write the appropriate measures opposite each of the causes of the ecological condition of the Black Sea (the first column).
- 2 Discuss all the suggested measures, allowing all participants to express their opinions, irrespective of whether they are representatives of different countries, international and business organisations or NGOs. Suggest to the participants that finding concrete and acceptable solutions is not an easy task. It takes time, patience and mutual respect on the part of all participants.
- 3 At the end of the conference ask all the participants to answer the question “What can I do as an individual to help preserve the Black Sea when I am at the seaside?” Write the most common answers in the third column. Discuss how they are similar to or different from the suggestions in the second column.

### Follow-up

1. Show the class the video clip Sea Warriors included in the video cassette.
2. Encourage the participants to suggest an appropriate appeal that relays the message of the film. Write the most appropriate suggestions on the board.





## Black Sea Facts

### General information

The Black Sea is one of the largest internal seas in the world. Its only connection with the rest of the world's seas is to the Mediterranean via the Bosphorus and Dardanelles straits in Turkey.

Its area, including the Sea of Azov, is some 461,000 square kilometres. Its average salinity of 18 parts per thousand is half that of the average salinity of the world's oceans because of the great influx of fresh water and lack of mixing with other saline waters.



Six countries share the Black Sea coast: Bulgaria, Georgia, Romania, Russia, Turkey and Ukraine. Nearly one-third of the European land mass drains into it. Major European rivers such as the Danube, Dnieper and Don, all flow into the Black Sea. Some 10.4 million people inhabit the coastal zones of the six Black Sea countries. For Bulgaria, Georgia, Romania and Ukraine this is their only maritime access.

**Physical and biological features** The seawater layer under 100 metres in depth contains 11-14 millilitres per litre of the toxic compound hydrogen sulphide. Thus there is almost no life below 150 metres, with the exception of some anaerobic bacteria. There is almost no mixing of the waters between 100-200 metres. The change in salinity between the two layers is permanent — a major feature of the sea. Due to this lack of mixing, the sea is permanently anoxic (devoid of oxygen) below 150-200 metres, which means that 90 percent of the sea volume is anoxic. There is a great debate as to whether the sea is becoming progressively more anoxic.

The Black Sea has a fairly rich biodiversity. There are 180 fish species and three species of dolphin. The endangered monk seal also inhabits the sea. However only five out of the 26 previously commercially valuable fish species are still viable today.

The Black Sea's shelf and river deltas are important spawning grounds for fish species. The coastal wetlands are important migration and breeding grounds for numerous rare and endangered European birds. In particular, the Danube Delta Biosphere Reserve in Romania is home to some 225 bird species.

**Threats to the Black Sea** The six Black Sea countries contribute about 70 percent of the total amount of material flowing into the Black Sea as waste from human activities. Some of this waste, and almost all of the remaining 30 percent (from the other 11 non-coastal countries) enter the Black Sea via the Danube River. Combined with the lack of major currents, poor water circulation and massive amount of nutrients discharged by the rivers, the environment of the Black Sea is suffering intensive decay.

The use of fertilisers and pesticides has increased dramatically to generate higher crop yields, while animal rearing has also boomed. The increased discharge of nutrients from industrial agriculture, as well as from manufacturing and households have ended up in the Black Sea. As a result, the sea grass and algal beds (a feature of the northwestern shelf) can not absorb the increased nutrient load. Large quantities of phytoplankton grew and blocked the light to larger plants below.

As a result, sea-grass meadows have begun to die off. Rotting organic matter and the bacteria working to break down the plants has used up the dissolved oxygen in the sea. This process, called "eutrophication," has been a major cause of the Black Sea's near biological collapse.

Sewage output into the sea has led to beach closures and financial losses for the tourist industry. Development and poor coastal zone management have destroyed much of the coast's natural beauty.

Annual financial losses caused by the degradation of the Black Sea have been estimated at EUR 180 million in the fisheries, and between EUR 330 million and 540 million in tourism.









Consumer Society

Health and Environment

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Citizens' Rights

Our Earth in the Future





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## Can One Person Make a Difference?

Author: Kliment Mindjov

<b>Major concept</b>	In a democratic society, people have the right to access information, and to participate in decision-making processes on environmental issues.
<b>Duration</b>	2-3 class periods
<b>Time of year</b>	Any
<b>Place</b>	Classroom
<b>Materials</b>	Green Pack video cassette
<b>Subjects</b>	Ecology, sustainable development, civic education
<b>Aims</b>	To illustrate the right to participate in decision-making processes on environmental issues
<b>Methods</b>	Discussion, brainstorming, role-playing

### Introduction

You, as a member of society, have the right to help determine the state of your environment.

Whether you are an office worker, farmer, teacher, bus driver or student, you, like anyone else, are surrounded by and live in an environment whose condition affects your health, working abilities and aesthetic perceptions. With certain, limited exceptions, you have the right to access environmental information, to participate in decisions affecting the environment, and to pursue legal action if these rights are denied.

You have a right to know, for example, whether economic activities in your community affect your health. And when decisions are made that may affect the environment, you have the right to take part in that process.



In 1998, a convention on citizens' rights to information, public participation and justice on environmental issues was signed by the European environmental ministers in Aarhus, Denmark. The Aarhus Convention lends society a strong tool for formulating and implementing an adequate environmental policy. It also improves social stability and confidence by providing citizens with the assurance that their voice is a significant part of the decision-making process.

## Activities

### The right to know

- 1 Explain to the class that in a democratic society, people have the right to access environmental information. However, for many years, environmental conditions and the impact of various activities have been kept secret. Today, the legislation in many European countries guarantees the right of people to gain access to such information. Furthermore, governments are responsible for making this access easy.
- 2 Ask a student to present the case study on Allergies and Environmental Pollution. Explain that, according to the Aarhus convention, local authorities are obliged to provide Dr. Watson with available information about the nature and quantity of the factory's emissions, within one month. If the municipality does not have this information, they should at least refer him to other institutions that would. There are several exceptions — mainly that authorities can refuse information if it is connected with national security or foreign affairs. In any case, however, this must be explained to Dr. Watson, along with the fact that if he is dissatisfied with the response of the authorities he is entitled to approach the court.
- 3 Regarding information in a neighbouring country, the Convention also guarantees the right of access to this data, assuming both countries have signed the Convention. The Convention prohibits discrimination against people or organisations according to citizenship, nationality or place of residence.
- 4 Local authorities are also obliged to collect environmental information in order to protect people's health. They must disseminate it in a timely manner through the local mass media. The publishing of periodic newsletters or daily broadcasts of environmental parameters should become a permanent practice of local and national authorities.



### The right to participate

- 1 Explain to students that there have been many causes in the past — political, economic and social — preventing public participation in decision-making processes on environmental issues. Today, the public participation principle is one of the main prerequisites for sustainable development, as it assists society in making better decisions with regard to the real needs of people and the environment. Citizens and civil organisations should have the opportunity to express their concerns and views regarding the environment before the authorities, and authorities should take into consideration the needs of the people. Ask another student to present the New Highway case study.



- 2 Explain to the class that, in all projects and activities related to metallurgy; waste management; industrial production; the construction of dams and roads; mining; the production of energy and chemicals; and other such activities; authorities are obliged to involve the public in the decision-making process. Authorities should therefore announce their intentions and plans by disseminating information in an easy-to-understand format and in a timely manner that allows an adequate period for response. This information should include thorough analyses of the possible impact the future activity might have on the environment. The procedure for preparing such information is called an environmental impact assessment (EIA).

Furthermore, authorities are obliged to organise a public discussion on any given project. The location, date and time of the meeting should be well publicised in advance. The public discussion should be organised before a decision is taken. The authorities are then obliged to take the different views and considerations presented into account. The decision itself should be based on the principle of general consensus, reflecting a maximum number of perspectives and minimising the potential impact the future development might have on people's health and the environment.

Public participation does not refer only to cases of new construction and production, but also to the development of plans, programmes or policies regarding the environment.

- 3 Explain to the class that to be able to exercise their rights of access to information and participation in decision-making processes regarding the environment, citizens need to have one more right – the right to contact, when necessary, any administrative or legal body. If people feel that they have not been provided with the right of access to the information needed or with access to the decision-making process, they can seek justice. In this case, the authorities must make this access free or at very low cost.



### Jobs or health?

View the educational film *Town's Dilemma: Jobs or Health?* Discuss the questions below in the following order:

- What imminent dangers would the construction of a new factory pose for nature and human health?
- What do people gain from the opening of the new factory?
- How do the participants in the film exercise their right to information and active participation?

### Follow-up

1. Find out whether there are similar cases where you live.
2. Discuss the cases and try to raise awareness about the clash of different public interests.
3. Try to convince the class that a consensus solution, which takes everyone's interests into account, though difficult, is the optimum approach in such cases.



## Allergies and Environment Pollution



Dr. Watson works in a small town close to a chemical factory. He has carefully observed the health status of his patients for many years. Dr. Watson says: "After close observation, I eventually discovered a relationship between the allergic diseases of my patients and the pollution caused by the chemical factory nearby. There are some rumours that its activity could be expanded soon and the local population has serious concerns about that. I would like to help, but to achieve more precise conclusions I need to know more about the nature of the emissions from the factory and their concentrations. I need access to the appropriate information.

"Furthermore, in the neighbouring country, right on the border, there is another factory, the activity of which also has impact on our town. In order to do my work accurately I also need up-to-date information about the pollution caused by that factory. I was told, however, that I cannot receive such information as I am a foreigner. I cannot understand what this has to do with my nationality when pollution is not confined by borders ... "



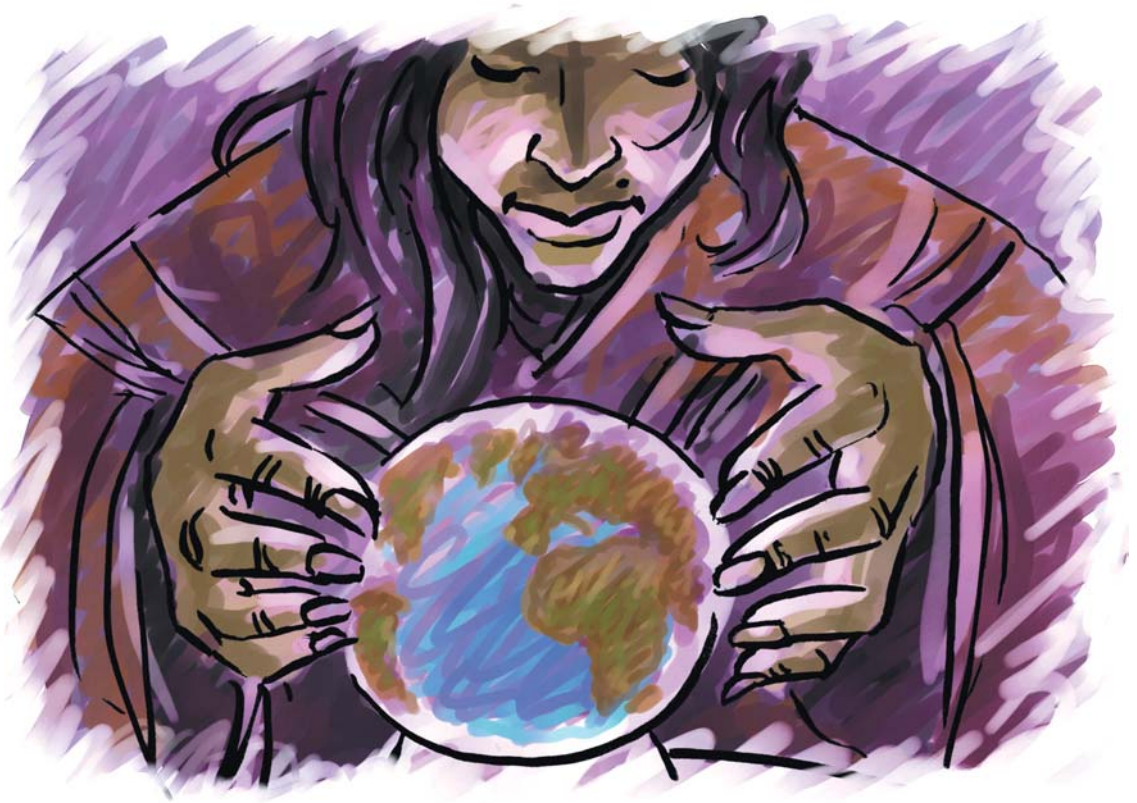
## New Highway

The Kalinowski family owns a farm close to a transport road. They would like to develop efficient stockbreeding there, but some recent information on plans for infrastructure changes has raised serious concerns.

Mr. Kalinowski says, "I am very worried by the amount and speed of construction lately. There is little left of the once calm and quiet village road. Now, they are planning to reconstruct it and build a highway here. This will increase the traffic and lead to higher levels of noise and pollution, which will have a negative impact on the productivity of my stock."

"Plans for the construction of a power transmission line are also alarming," adds Mrs. Kalinowska. "I have heard that electro-magnetic waves have a negative effect on human and animal health, and they even suppress the normal growth of plants. What will happen to our business then?"





## Our Responsibilities Toward Future Generations

Author: **Kliment Mindjov**

<b>Major concept</b>	Environment preservation should be considered an indelible part of development.
<b>Duration</b>	2-3 class periods
<b>Time of year</b>	Any
<b>Place</b>	Classroom
<b>Materials</b>	Posters, the Green Pack video cassette, CD-ROM
<b>Subjects</b>	Geography, biology, ecology, sustainable development
<b>Aims</b>	<ul style="list-style-type: none"> <li>• To discuss specific cases of sustainable development</li> <li>• To raise student awareness of the basic principles of sustainable development</li> <li>• To reflect on the challenges confronting the environment and developments on Earth in the years to come</li> </ul>
<b>Methods</b>	Lecture, discussion, video presentation

### Introduction

The United Nations Conference on Environment and Development, held in Rio de Janeiro in June 1992, was a remarkable event. The heads of 179 states and representatives of numerous countries, international organisations and non-governmental organisations were in attendance. This conference demonstrated that humanity could no longer treat the environment separately from economic development. The conference led to the acceptance of a world action plan called Agenda 21, an action programme spanning the next 100 years.





Agenda 21 seeks to achieve two goals on a global scale: a high quality environment, and a stable economy for all nations of the world. This historical document is an exhaustive look at sustainable development. The Rio Declaration contains the basic principles that must underline future state decisions and policies. These principles can be found on page 196.

A decade later, the World Summit on Sustainable Development in Johannesburg gathered more than 50,000 participants, including heads of states, leaders and representatives of international NGOs and business groups. Attention was focused on the need to remove the barriers to sustainable development in modern societies, to alleviate poverty and disease, to manage natural resources rationally, to promote responsible consumption and production, and to use the benefits of globalisation to strike a balance between development and environment.

## Activities

### Easter Island

- 1 Explain that the Earth's natural processes regulate one another, and that nature itself regenerates as a result. Aggressive and irrational human activities can upset the balance of natural processes, causing irreversible changes to ecosystems.
- 2 Read and discuss the Easter Island case study in class.
- 3 Explain that it is an example of an ecosystem that is completely isolated from the rest of the world, and that the society collapsed because the population outgrew the resources available to it.
- 4 Discuss the parallels between Easter Island and the Earth's environment today.

### Generations to come

- 1 Explain that sustainable development means using resources in a way that they are allowed to regenerate fully, giving future generations access to the same resources we enjoy today. In essence, it means passing on the world in the same state that we inherited it.
- 2 Ask the students to generate their own definition of the term sustainable development. Help their brainstorming by offering and discussing some of the following statements:
  - The total fish catch should not exceed the sustainable yield of fisheries.
  - The amount of water pumped from underground aquifers should not exceed aquifer recharge.
  - Soil erosion should not exceed the natural rate of new soil formation.
  - Tree cutting should not exceed tree planting.
  - Carbon emissions should not exceed the capacity of nature to process atmospheric carbon dioxide.
  - Plant and animal species must not be eliminated faster than new ones evolve.
- 3 Generate and discuss other statements similar to the ones provided.
- 4 As a follow-up, ask the students to make up their own definition of the "sustainable development" concept. Write some of them on the board and discuss them.



## Principles of sustainable development

- 1 Give the students the worksheet on Basic Principles of the Sustainable Development and discuss them.
- 2 Study the information about the World Summit in Johannesburg mentioned in the example. Discuss the basic challenges facing the people in the 21st century and the most important measures, earmarked by the governments' representatives, the NGOs and the international organisations and the business world.
- 3 Discuss each of the challenges mentioned in the text and decide which are relevant in your country or will be in the years to come. Use the additional information on the CD-ROM.

### Handle with care (for younger students)

- 1 Show the Handle with Care video clip and discuss it in the context of the previous activities.
- 2 Have the students write a composition, draw a picture, create short poems or rhymes using the themes of the video clip and the discussions of the environmental responsibility toward future generations.

### The chain of life (for older students)

- 1 Show the video clip The Kingdom.
- 2 Discuss the well-known English story in the context of sustainable development:  

"For want of a nail, the shoe was lost;  
For want of the shoe, the horse was lost;  
For want of the horse, the rider was lost;  
For want of the rider, the battle was lost;  
For want of the battle, the kingdom was lost;  
And all for the want of a nail."
- 3 What does the old man mean when he says "... to break the chain?" How do human activities influence this?
- 4 Is the old man correct when he asks "Why are we given wisdom at such a high price?"
- 5 After the viewing, encourage the students to write an essay about their impressions, thoughts or feelings.



### Follow-up

- Ask the students to find additional information on the future of the Earth and the challenges facing the environment and development. Make sure they have access to the CD-ROM and the Internet.





## Easter Island

Easter Island is located in the Pacific Ocean, about 3,200 kilometres west of South America. The first settlers, who reached the Islands about 15 centuries ago, were the Polynesians.

The island has a semiarid climate, but it was ameliorated by a verdant forest that trapped and held water. Its 7,000 people raised crops and chickens, caught fish and lived in small villages. The Easter Islanders' legacy can be seen in massive, eight-metre high, obsidian statues that were hauled across the island using tree trunks as rollers.

By the time European settlers reached Easter Island in the 17th century, these stone statues, known as Moai, were the only remnants of a once impressive civilisation — one that collapsed in just a few decades.

The demise of this society was triggered by the decimation of its limited resource base.

As the Easter Island human population expanded, its inhabitants cut down forests and converted more and more land for agriculture. Trees were used for heating, the construction of houses and boats, and religious purposes (transport of the Moai statues).

The time came when the last tree disappeared from the island. No more fishing boats could be constructed, and consequently the food supply became insufficient. The destruction of forests led to erosion and further food shortage. People gradually moved to the caves. Armed conflicts followed, slavery was revived, and some people even became cannibals in order to survive.





## Main Principles of Sustainable Development (Rio de Janeiro Declaration on the Environment and Development, 1992)

- Everyone has the right to a healthy and productive life in harmony with nature.
- Present and future generations are equally entitled to this right.
- Environmental protection must be seen as an integral part of any development process.
- Each country has the right to utilise its own resources, without affecting the environment beyond its borders.
- The polluter must compensate the damage caused to the environment — “Polluter Pays” principle.
- Economic activities are combined with the principle of acquiring preventive measures for environment protection.
- States must cooperate for environment protection.
- The alleviation of poverty and living standards inequity in the different parts of the world are an integral part of sustainable development.
- States must limit and extinguish the unsustainable models of production and consumption, and enhance the appropriate demographic policy.
- The most efficient way of solving environmental problems is the involvement of all interested parties.
- States must develop and encourage the informed participation of the population in decision-making processes.
- States must develop and implement effective legislation for environmental protection.
- Environmental protection must involve all social groups.
- Peace, development, and environmental protection are inter-dependent and indivisible.





# Johannesburg Summit 2002

The World Summit on Sustainable Development brought together tens of thousands of participants, including heads of state and government, national delegates and leaders from NGOs, businesses and other major groups.

Attention was focused on the need to remove the barriers to sustainable development in modern societies, alleviate poverty and disease, manage natural resources rationally, promote responsible consumption and production, and to use the benefits of globalisation to strike a balance between development and environment.



The basic challenges and their consequences are:

- **Population:** In the beginning of the 21st century the population of the Earth reached 6 billion, and is expected to level out between 10 and 11 billion over the next 50 years. The basic challenges will be shortages of drinking water and arable land for food production.
- **Poverty and Inequality:** Almost 25 percent of the world's population lives on less than USD 1 per day. Because inequality continues to be a serious obstacle to sustainable development, the Summit pledged to bring this percentage down to between 12-13 percent, along with the number of people suffering from undernourishment.
- **Food and Agriculture:** The fall of food prices over the past 30 years may have contributed to increases in consumption, but in many regions of the world arable terrains are limited, and the creation of new ones has a destructive effect on the remaining ecosystems. In the future, the growth of food production should not come at the expense of nature. By 2010 the current pace of biodiversity loss should be significantly slowed.
- **Drinking Water:** The shortage of drinking water in many regions of the world is a major barrier to sustainable development. It is expected that, at the current rate of development, every second person will suffer from water shortage by the year 2025. The Summit pledged to halve the number of people lacking access to clean drinking water and basic hygienic needs by 2015.
- **Human Health:** In many cases, deaths in developing countries are avoidable. Humanity should direct more attention and money in the coming years to the struggle against diseases. The imminent task is to reduce the death rate among children under five years of age by two-thirds, and the death rate of young mothers by 75 percent by 2015.
- **Energy:** Consumption of all forms of energy is continually rising. The improvement of access to reliable, sustainable and environmentally friendly energy sources and services, as well as the creation of national programmes for energy effectiveness, is a particularly important task for the next 10-15 years.
- **Forests:** The world's forests diminish mainly due to expansion of agriculture. In the coming years, improving the recovery and management of the forests will be of utmost importance.
- **Climate Change:** Petrol consumption is constantly rising. The Summit emphasised the need to realise the decisions of the Kyoto Protocol for reaching an agreement on emissions norms for greenhouse gases in developed countries.

The Summit declared the following tasks for humanity as imperative:

- the need for better understanding of the "sustainable development" concept and stabilising the relevant institutions at international, regional and national levels; and
- further endorsement of civil society's role and the promotion of partner initiatives between the private and public sectors.

