

IMPACTS AND POLLUTION

Teachers' Notes

Impacts and Pollution

OUR INFLUENCE ON THE ENVIRONMENT

Goals of the module

Environmental awareness and care is built on an understanding of the consequences of our current actions and lifestyles. This module is particularly focused on consequences: it looks at the quality of our environment and how we influence it. The module promotes greater scientific understanding of air and water in particular, investigates how they are polluted and explores how reduced environmental quality affects the planet and our health. It also attempts to widen the topic by introducing the current and complex debate over wind energy developments in Ireland. These developments have clear benefits for national energy policy and the global environment because they reduce dependence on fossil fuels and consequent greenhouse gas emissions. On the other hand, many worry about negative environmental impacts such as visual intrusion and noise. Striking the right balance in this scenario is a good example of the challenge presented by many environmental issues.

Although the focus of the module is on consequences, it is intended to be much more than a simple

call to change personal behaviour: in particular it is not intended to focus all the responsibility for environmental problems on the individual. The goal of the module is to raise consciousness, leading to changes in behaviour, a higher profile for environmental protection and greater prioritisation of the environment in politics and society as a whole.

Curriculum links

This pack is relevant to SESE, Science, in particular the following strand units: Environmental awareness and care (become aware of the importance of the Earth's renewable and non-renewable resources, explore some examples of the interrelationship of living and non-living aspects of local and other environments, identify and discuss a local, national or global environmental issue and foster an appreciation of the ways in which people use the Earth's resources); Human life (variety and characteristics of humans; human life processes); Plant and animal life (processes of life); Science and the environment (recognise and investigate human activities which have a positive or adverse effect

on local and wider environments, recognise the contribution of scientists to society).

The pack also links well to the SESE, Geography strand unit Environmental awareness and care (strands as above) and Weather, climate and atmosphere (the water cycle, atmospheric pollution). SPHE links include Developing citizenship and Myself and the wider world.

Overview of the topic

There is no end to the range of interactions between humans and the wider environment, or to the extent of human impacts. This module concentrates on some of the most important areas of pollution—pollution of air and water—to illustrate the importance of considering our impacts and addressing the problems they create.

Water Monitoring of our rivers shows that about 70% are of satisfactory water quality and 29% are slightly or moderately polluted, while only 1% are seriously polluted. About 85% of lakes have satisfactory water quality. Water quality in most cases is good, but many local problems remain: there are about 150 fish kills reported every year.

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The main sources of pollution are from sewage treatment and agriculture. Spillages from these sources can introduce toxins directly into water bodies. Often the problems caused relate to 'eutrophication', where the nutrients in the pollution allow algae to flourish in the water. These algae then use up all the oxygen in the water, thus starving other inhabitants of the oxygen they need. This is one of the most common ways fish kills occur.

Other pollution in rivers and lakes might be directly toxic, from heavy metals or organic compounds (such as those from industrial sources, illegally dumped waste or chemicals used on farms). In fact, a river that looks crystal clear and totally empty should arouse suspicion: a

healthy river is full of plants and other living things and should not be totally clear and empty.

Air The air testing exercise (Something in the air?) shows readily how much 'stuff' there is in air. Most of these particles are harmless and our air passages and lungs filter them out.

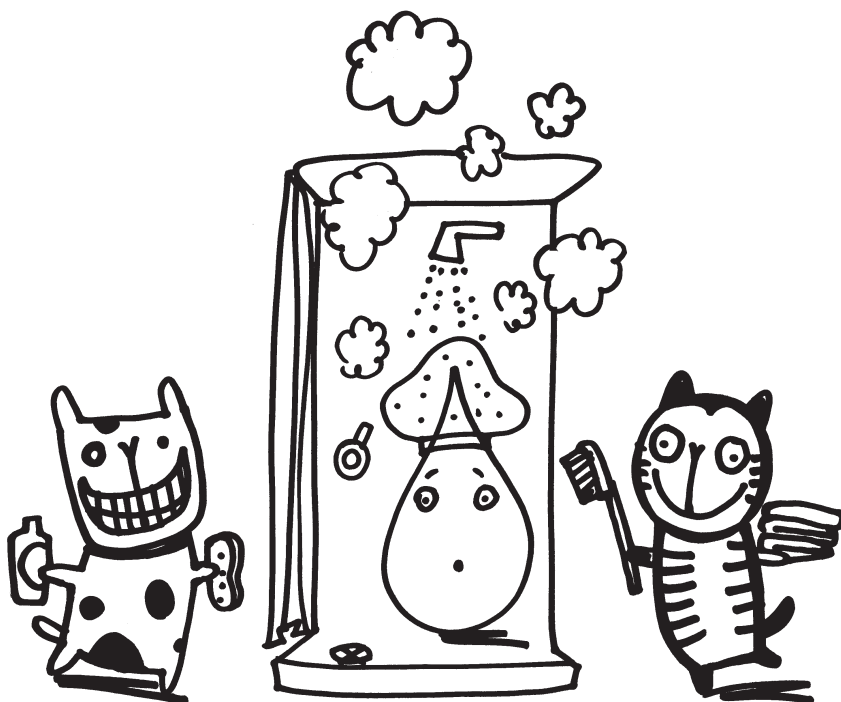
However, there are cases where pollution in air can harm our health. Twenty years ago the most high profile air pollution problem in cities like Dublin and Cork was smog, associated with the burning of coal in household fires. This pollution caused severe respiratory health problems for many people. It has been very successfully tackled through a ban on the sale of smoky fuels in urban areas (recently extended to

many other large towns across the country), and the benefits are very tangible.

The most significant cause of air pollution in cities and towns now is traffic: cars, buses and trucks. Small particles in the air, coming mainly from diesel engine emissions, can cause damage to the respiratory system. Our system filters out most dust particles, but the problem comes from particles too small to get caught. Other pollutants of concern include nitrogen oxides and volatile organic carbons, a range of substances coming from both petrol and diesel. The problem should not be overstated: urban air quality is generally quite good and well within international recommended standards. Some progress is being made in improving car engine technologies to reduce emissions, but ultimately it is the volume of traffic that is behind the problem.

Outside of cities and towns the local air quality is usually much better, but there can be occasional specific exceptions. The more pressing issue for air pollution beyond specific urban problems relates to global environmental issues rather than local ones. Two problems are of highest priority—acidifying gases and greenhouse gases.

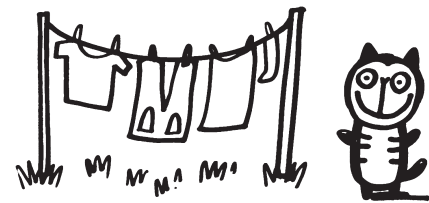
The compounds that cause acid rain (including sulphur dioxide,



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nitrogen oxides and ammonia) are known as the acidifying gases. The biggest source of these gases is electricity generating stations, which means the problem results from our use of electricity, and this makes it difficult to reduce the emission of these gases. Power stations can install extra technology to reduce emissions, and most of the bigger stations have now done this. The real solution lies in generating electricity more efficiently and, in particular, making sure our consumption of electricity is efficient so that we use no more than we really need. The other main source of acidifying gases is traffic, already discussed. Acidifying gases now represent one of Ireland's most challenging environmental issues, particularly if we are to comply with our international legal obligations.

The second main global environmental problem relating to air pollution is climate change,

or the greenhouse effect. Certain gases that are emitted from the burning of fossil fuels (but some from other activities too) trap the heat of the sun in the atmosphere: over time this is leading to major changes in the Earth's climate. No one knows what the long term effects will be, but already many scientists are linking the extreme weather and frequent storms of recent years to these climate change processes. All of our energy use, from electricity, gas, coal, oil and peat in our homes to petrol in our cars, results in the emission of carbon dioxide and other greenhouse gases. Ireland, under the Kyoto Protocol, has tough international targets to meet on limiting emissions of the main greenhouse gases.

What can students do?

Individual decisions affect how much we pollute the air and water around us. These decisions include:

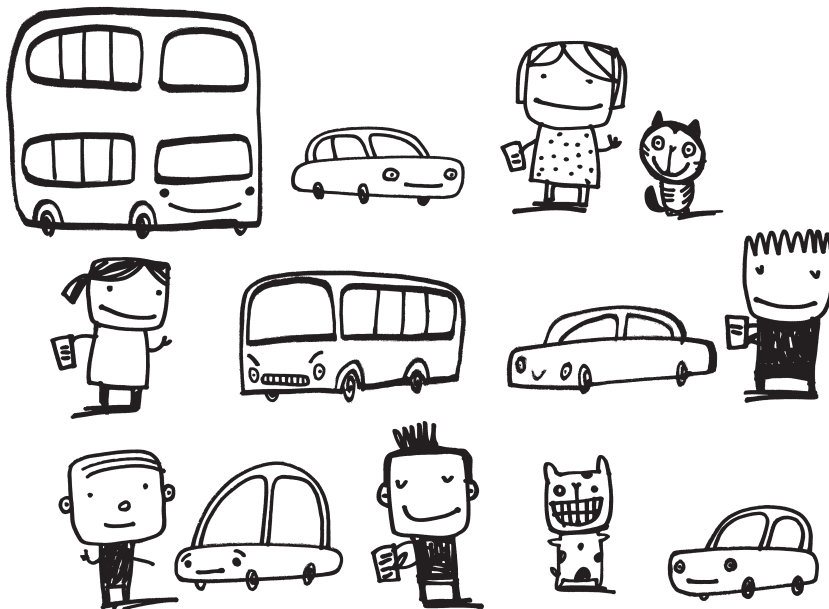
- How we travel—Do you always travel by car?
- Using energy in the home—Are your lights, appliances and heaters on when you don't need them?
- Chemicals in the home—What's that you're pouring down the drain?
- Buying things—How much energy did it take to package that up and transport it here?

On a day-to-day-basis it's not possible to control everything we do. For many people change can seem difficult—there may be no alternative to the car for getting around or it may be difficult to find information on how to cut down our electricity usage at home or how to avoid overpackaged products. A lot of these issues are larger scale, but the support of individuals will be needed if national efforts to change things for the better are to be successful. The areas that

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need most attention are those that have most impact—traffic, energy use and farming, to name but a few. Many good environmental protection laws have been put in place, and key environmental successes include the ban on smoky coal already mentioned, the plastic bag tax and farm plastics recycling. Enforcement of these laws is now receiving more attention and we will hopefully see the benefits quickly.

Where to go for more information

- The new EPA report Ireland's Environment 2004 (available on www.epa.ie) is an excellent source of in-depth information—see Chapters 2, 3,

4 and 15 and particularly Chapter 16 on pollution and human health.

- Enfo www.enfo.ie (also St Andrew's St, Dublin 2) has a huge amount of material on all environmental topics for all age groups.
- TeachNet Ireland
www.teachnet.ie has a good learning project on electricity in the SESE Science section.
- Sustainable Energy Ireland
www.sei.ie has great schools' resources and lots on the environmental impacts of energy use.

The impacts and pollution pack-content overview

1. Take a deep breath! Investigating lung capacity

Introduces the impacts and pollution topic, gets children thinking about how we rely on the environment for fresh air to survive. Students investigate why we need air and how much air our lungs can hold.

Theme Demonstration (D)
and Class activity (CA)

Curricular Strands

SESE, Science–Human life;
Variety and characteristics of
humans; Human life processes;
Caring for the environment

Skills Questioning, observing, predicting and estimating

Time 20 minutes introduction;
20 minute investigation

2. Something in the air? Investigating air quality

Introduces the idea of particles and pollution in the air, investigating the air around us to see how clean it is. Stimulates discussion on the importance of clean air. Students investigate the air quality in their school grounds and consider possible air pollutants in their locality.

Theme Class activity (CA)

Curricular Strands

SESE, Science and Geography–
Environmental awareness and care

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SESE Science–Plant and animal life; Processes of life; Science and the environment

Skills Questioning, observing, predicting, designing and making, recording and analysing

Time 15 minutes introduction; 30–35 minutes investigation and analysis

3. Up in smoke! Investigating acid rain

Creating an understanding of what acid rain is, how it is formed and what its effects are, through experiments conducted by the students. The class discusses the impacts of burning fossil fuels and investigates the effects of acid rain on soil and plants.

Theme Class activity (CA)

Curricular Strands

SESE, Science and Geography–Environmental awareness and care

SESE, Science–Science and the environment; Plant and animal life; Processes of life

SESE, Geography–Natural environments; Rocks and soils; Soils

SPHE–Myself and the wider world; Environmental care

Skills Questioning, observing, predicting, recording and estimating

Time 20 minutes introduction; 30 minute investigation

4. Car counting Surveying traffic in your area

Raising awareness of pollution and safety issues associated with road traffic. Asking students to think about the impacts of traffic on their locality. The class investigates how much traffic there is in the area and discusses the effects of traffic on the local environment.

Theme Demonstration (D) and Class activity (CA)

Curricular Strands

SESE, Science and Geography–Environmental awareness and care

Skills Questioning, observing, predicting, investigating, estimating and analysing

Time 20 minutes introduction; 30 minute investigation

5. Gale force A role play about wind farms

Encouraging a balanced discussion on issues surrounding energy and the impacts of producing it, looking at a complex issue from different points of view. A role-play debate on a proposal to build a wind farm in the local area.

Theme Class activity (CA)

Curricular Strands

SESE, Science and Geography–Environmental awareness and care

SPHE–Developing citizenship

Drama–Drama to explore feelings, knowledge and ideas,

leading to understanding

Skills Analysing, empathising, communicating, recording

Time 40 minutes

6. Cool clear water Investigating ways of purifying water

Thinking about clean water as a valuable commodity, getting a sense of the amount of water we use and what it takes to provide this resource. The class consider water as a vital natural resource and explore how we use water and investigate methods of water purification.

Theme Demonstration (D) and Class activity (CA)

Curricular Strands

SESE, Science and Geography–Environmental awareness and care

SESE, Science–Materials, mixing and other changes

Skills Questioning, observing, predicting, investigating, estimating and analysing

Time 20 minutes introduction; 30 minute investigation