

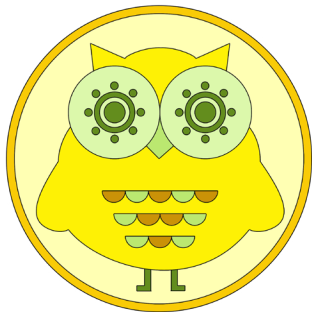
MIRACLE

BOOKLET 1

Understanding Climate Change for Primary School Teachers: A Practical Guide



MIRACLE



L-Università
ta' Malta



AGRUPAMENTO DE ESCOLAS TERRAS DO AVE



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Understanding Climate Change for Primary School Teachers: A Practical Guide

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Introduction

In an era marked by unprecedented environmental challenges, it has become increasingly crucial to instill a deep understanding of climate change in the hearts and minds of our future generations. At the forefront of this educational effort are our dedicated primary school teachers, who play a pivotal role in shaping young minds and nurturing the environmental stewards of tomorrow.

Climate change, driven by human activities and the subsequent alteration of our planet's delicate balance, is a global crisis that demands attention, understanding, and action. To address this pressing issue effectively, we need to ensure that primary school teachers are well-equipped with the knowledge and skills to teach the basic science behind climate change.

This booklet, "Understanding Climate Change for Primary School Teachers: A Practical Guide," is tailored to the unique needs and challenges faced by primary school educators. It is our collective responsibility to empower these educators with the tools and knowledge they need to communicate the science of climate change in a way that captivates and enlightens young minds.

Throughout the pages of this booklet, we will delve into the fundamental concepts of climate change, breaking down complex scientific ideas into simple and relatable terms. Our goal is to help you, the primary school teacher, not only grasp the basic science behind climate change but also to inspire your students to become informed, engaged, and motivated advocates for a sustainable future.

As we embark on this educational journey, let us remember that by equipping our teachers with the knowledge and skills they need, we are taking a significant step towards addressing climate change. The impact of our work in the classroom extends far beyond the walls of the school, as it shapes the attitudes and actions of future generations. Together, we can create a generation of environmentally-conscious, informed, and empowered individuals who will work towards a more sustainable and harmonious world.

Section 1: What is Climate Change?

Climate change is a term you've likely heard before, but what exactly does it mean? Let's break it down without diving into complex scientific jargon.

Climate Change in Simple Terms

Climate change is like the way our planet's temperature and weather patterns are gradually shifting over time. Think of it as our Earth having its own kind of "mood swings." Just like we have seasons where it gets warmer in the summer and cooler in the winter, the Earth also has its own long-term patterns. But now, these patterns are changing, and it's not just about the weather getting a little hotter or colder.

A Closer Look

You see, our Earth has a cozy blanket of air around it called the atmosphere. This blanket helps keep our planet warm enough for us to live comfortably. It's made up of gases, like the air we breathe. But when we burn things like fossil fuels (think of oil, gas, and coal) for energy, it releases extra gases into the atmosphere, especially one called carbon dioxide.

These extra gases act like an extra thick blanket for our Earth. It's as if we're turning up the heat in our planet's cozy home. This thicker blanket traps more heat from the sun, making our planet warmer. And when the Earth gets warmer, it can cause all sorts of changes in the weather.

So, in a Nutshell

Climate change is when our planet's average temperature goes up because of all these extra gases in the atmosphere. It's like the Earth is getting a little too toasty. This warming can lead to more extreme weather events, like super hot summers, severe storms, and even melting ice at the North and South Poles.

Understanding climate change is crucial because it affects the world we live in, from the air we breathe to the places we call home. And as primary school teachers, you play a key

role in helping your students grasp these basic concepts and prepare them to become responsible Earth stewards.

The United Nations on Climate Change

Climate change refers to long-term shifts in temperatures and weather patterns. Such shifts can be natural, due to changes in the sun's activity or large volcanic eruptions. But since the 1800s, [human activities have been the main driver of climate change](#), primarily due to the burning of fossil fuels like coal, oil and gas.

Burning fossil fuels generates greenhouse gas emissions that act like a blanket wrapped around the Earth, trapping the sun's heat and raising temperatures.

The main greenhouse gases that are causing climate change include carbon dioxide and methane. These come from using gasoline for driving a car or coal for heating a building, for example. Clearing land and cutting down forests can also release carbon dioxide. Agriculture, oil and gas operations are major sources of methane emissions. Energy, industry, transport, buildings, agriculture and land use are among the [main sectors](#) causing greenhouse gases.



Figure 1 - "The Earth is feeling the heat", United Nations

Humans are responsible for global warming

Climate scientists have showed that [humans are responsible](#) for virtually all global heating over the last 200 years. Human activities like the ones mentioned above are causing greenhouse gases that are warming the world faster than at any time in at least the last two thousand years.

[The average temperature of the Earth's surface is now about 1.1°C warmer](#) than it was in the late 1800s (before the industrial revolution) and warmer than at any time in the last 100,000 years. [The last decade \(2011-2020\) was the warmest on record](#), and each of the last four decades has been warmer than any previous decade since 1850.

Many people think climate change mainly means warmer temperatures. But temperature rise is only the beginning of the story. Because the Earth is a system, where everything is connected, changes in one area can influence changes in all others.

[The consequences of climate change](#) now include, among others, intense droughts, water scarcity, severe fires, rising sea levels, flooding, melting polar ice, catastrophic storms and declining biodiversity.



Figure 2 - "The Earth is asking for help", United Nations

People are experiencing climate change in diverse ways

Climate change can affect our [health](#), ability to grow food, housing, safety and work. Some of us are already more vulnerable to climate impacts, such as people living in small island nations and other developing countries. Conditions like sea-level rise and saltwater intrusion have advanced to the point where whole communities have had to relocate, and protracted droughts are putting people at risk of famine. In the future, the number of people displaced by weather-related events is expected to rise.

Every increase in global warming matters

In a series of [UN reports](#), thousands of scientists and government reviewers agreed that limiting global temperature rise to no more than 1.5°C would help us avoid the worst climate impacts and maintain a livable climate. Yet policies currently in place point to a [2.8°C temperature rise](#) by the end of the century.

The emissions that cause climate change come from every part of the world and affect everyone, but [some countries produce much more than others](#). The seven biggest emitters alone (China, the United States of America, India, the European Union, Indonesia, the Russian Federation, and Brazil) accounted for about half of all global greenhouse gas emissions in 2020.

Everyone must take climate action, but people and countries creating more of the problem have a greater responsibility to act first.

We face a huge challenge but already know many solutions

Many climate change solutions can deliver economic benefits while improving our lives and protecting the environment. We also have global frameworks and agreements to guide progress, such as the [Sustainable Development Goals](#), the [UN Framework Convention on Climate Change](#) and the [Paris Agreement](#). Three broad categories of action are: cutting emissions, adapting to climate impacts and financing required adjustments.

Switching energy systems from fossil fuels to [renewables like solar or wind](#) will reduce the emissions driving climate change. But we have to act now. While a growing number of countries

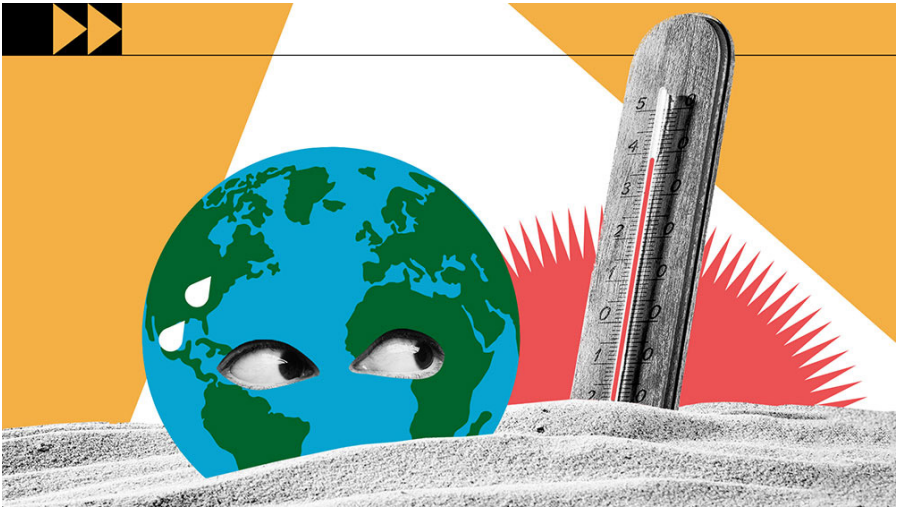


Figure 3 - "Photocomposition: an image of the world globe looking worried to a thermometer with raising temperatures", United Nations

is committing to [net zero emissions](#) by 2050, [emissions must be cut in half](#) by 2030 to keep warming below 1.5°C. Achieving this means huge declines in the use of coal, oil and gas: over two-



Figure 4 - "Growing coalition", United Nations

thirds of today's proven reserves of [fossil fuels need to be kept in the ground](#) by 2050 in order to prevent catastrophic levels of climate change.

[Adapting](#) to climate consequences protects people, homes, businesses, livelihoods, infrastructure and natural ecosystems. It covers current impacts and those likely in the future. Adaptation will be required everywhere, but must be prioritized now for the most vulnerable people with the fewest resources to cope with climate hazards. The rate of return can be high. Early warning systems for disasters, for instance, save lives and property, and can deliver benefits up to 10 times the initial cost.

We can pay the bill now, or pay dearly in the future

Climate action requires significant [financial investments](#) by governments and businesses. But climate inaction is vastly more expensive. One critical step is for industrialized countries to fulfil their commitment to provide \$100 billion a year to developing countries so they can adapt and move towards greener economies.



Figure 5 - "Climate finance", United Nations

Section 2: Causes of Climate Change According to the European Commission

Burning fossil fuels, cutting down forests and farming livestock are increasingly influencing the climate and the earth's temperature. This adds enormous amounts of greenhouse gases to those naturally occurring in the atmosphere, increasing the greenhouse effect and global warming.

Global warming

2011-2020 was the warmest decade recorded, with global average temperature reaching 1.1°C above pre-industrial levels in 2019. Human-induced global warming is presently increasing at a rate of 0.2°C per decade.

An increase of 2°C compared to the temperature in pre-industrial times is associated with serious negative impacts on to the natural environment and human health and wellbeing, including a much higher risk that dangerous and possibly catastrophic changes in the global environment will occur.

For this reason, the international community has recognised the need to keep warming well below 2°C and pursue efforts to limit it to 1.5°C.

Greenhouse gases

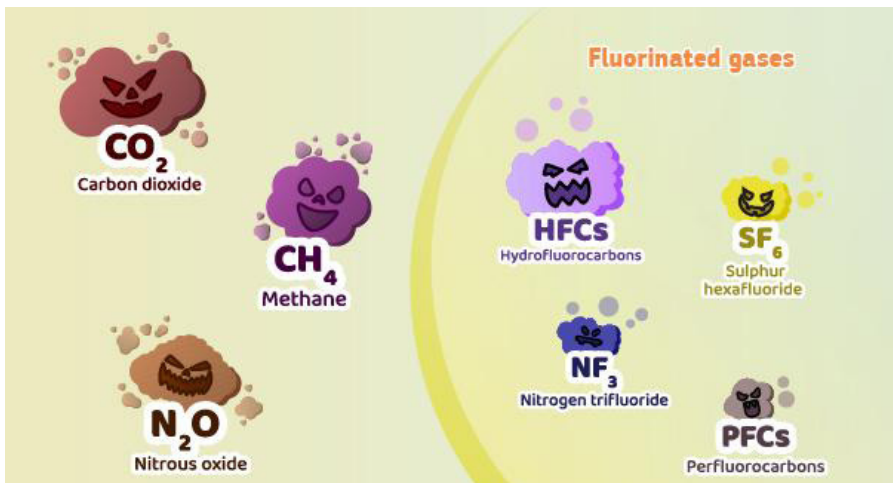


Figure 6 - "Greenhouse gases", European Commission. Climate Action

The main driver of climate change is the greenhouse effect. Some gases in the Earth's atmosphere act a bit like the glass in a greenhouse, trapping the sun's heat and stopping it from leaking back into space and causing global warming.

Many of these greenhouse gases occur naturally, but human activities are increasing the concentrations of some of them in the atmosphere, in particular:

- carbon dioxide (CO₂)
- methane
- nitrous oxide
- fluorinated gases

CO₂ produced by human activities is the largest contributor to global warming. By 2020, its concentration in the atmosphere had risen to 48% above its pre-industrial level (before 1750).

Other greenhouse gases are emitted by human activities in smaller quantities. Methane is a more powerful greenhouse gas than CO₂, but has a shorter atmospheric lifetime. Nitrous oxide, like CO₂, is a long-lived greenhouse gas that accumulates in the atmosphere over decades to centuries. Non-greenhouse gas pollutants, including aerosols like soot, have different warming and cooling effects and are also associated with other issues such as poor air quality.

Natural causes, such as changes in solar radiation or volcanic activity are estimated to have contributed less than plus or minus 0.1°C to total warming between 1890 and 2010.

Causes for rising emissions

- **Burning coal**, oil and gas produces carbon dioxide and nitrous oxide.
- **Cutting down forests (deforestation)**. Trees help to regulate the climate by absorbing CO₂ from the atmosphere. When they are cut down, that beneficial effect is lost and the carbon stored in the trees is released into the atmosphere, adding to the greenhouse effect.
- **Increasing livestock farming**. Cows and sheep produce large amounts of methane when they digest their food.
- **Fertilisers** containing nitrogen produce nitrous oxide emissions.



Figure 7 - "Causes for rising emissions", European Commission. Climate Action

- **Fluorinated gases** are emitted from equipment and products that use these gases. Such emissions have a very strong warming effect, up to 23 000 times greater than CO₂.

Countering climate change

As every tonne of CO₂ emitted contributes to global warming, all emissions reductions contribute to slowing it down. In order to stop global warming completely, CO₂ emissions have to reach net zero worldwide. In addition, reducing emissions of other greenhouse gases, such as methane, can also have a powerful effect on slowing global warming – especially in the short term.

The [consequences of climate change](#) are extremely serious, and affect many aspects of our lives. Both countering climate change and adapting to a warming world are top priorities for the EU. We need climate action now. Find out about [what the EU is doing to fight the climate crisis](#).

Everyday Heroes: How Our Actions Affect the Earth

Now that we've grasped the basics of what climate change is, let's explore the causes in a way that's easy to understand. To help teachers convey these ideas to students, let's use a couple of relatable examples.

The Magic Car Ride

Imagine if you had a magical car that could take you anywhere. But this magic car had a special power - it ran on something called gasoline. When you drove it, the car released tiny, invisible things into the air. These things are like invisible blankets around our planet, just like the ones we use to stay warm at night. But the more you drive, the more of these invisible blankets are released into the air. Over time, the blankets pile up, and our planet gets warmer.

This is kind of like what happens with real cars. When we drive cars that run on gasoline or other fossil fuels, they release a gas called carbon dioxide (CO₂) into the air. Just like the magic car's blankets, this CO₂ acts as an extra-thick blanket for our Earth. The more we drive, the thicker the blanket, and the warmer our planet becomes. It's one of the reasons why it's important to use cars that don't produce as many of these blankets, like electric cars or bikes.

The Forest Friends

Think about a beautiful forest with lots of tall trees. These trees are like the Earth's lungs - they breathe in the bad air (carbon dioxide) and breathe out the good air (oxygen). It's like they're giving the Earth a big, clean, and fresh breath.

But when people cut down these trees or burn them, it's like taking away the Earth's breath. Imagine if you had to wear a mask that made it harder to breathe - you might feel hot and uncomfortable.

That's what happens when we cut down too many trees. The Earth's "breathing" becomes harder, and more of that warming gas, carbon dioxide, stays in the air.

So, cutting down trees, called deforestation, and using wood for things like paper or building houses can make our planet

warmer. It's essential to take care of our forests and even plant more trees to help our Earth breathe better.

These examples help us understand that climate change isn't something far away or complicated. It's connected to everyday things we do, like driving cars and taking care of our forests. By making small changes, we can all be part of the solution to climate change.

Section 3: The Greenhouse Effect

Basic Knowledge

- The sun emits shortwave radiation, which passes through Earth's atmosphere and is absorbed by Earth's surface.
- Some energy is re-emitted back into the atmosphere, as longwave radiation.
- 'Greenhouse' gases: carbon dioxide, nitrous oxide, methane, water vapor effectively prevent some of this longwave radiation from leaving the atmosphere.
- This warms Earth's atmosphere, making our planet habitable.
- Human activities have led to a buildup of extra greenhouse gases in the atmosphere.
- As a result, average surface temperatures are rising.
- Temperatures will continue to rise if greenhouse gases keep building up in the atmosphere.

The Greenhouse Effect Explained

The Earth's atmosphere is mainly composed of a mixture of only a few gases-nitrogen, oxygen, and argon; combined these three gases comprise more than 99.5% of all the gas molecules in the atmosphere. These gases which are most abundant within the atmosphere exhibit almost no effect on warming the Earth and its atmosphere since they do not absorb visible or infrared radiation. However, there are minor gases that comprise only a small portion of the atmosphere (about 0.43% of all air molecules, most of which are water vapor at 0.39%) that do absorb infrared radiation. These "trace" (very small quantities)

gases contribute substantially to the warming of the Earth's surface and atmosphere due to their characteristic to absorb the infrared radiation emitted by the Earth (see below for details on the Greenhouse Effect). Since these trace gases influence the Earth in a manner somewhat similar to a greenhouse, they are referred to as GreenHouse Gases, or GHGs.

It is known that a greenhouse allows sunlight to enter while it retains the heat created to warm up the plants and air inside even during nighttimes. The atmospheric greenhouse effect is similar to that but instead of the glass walls and roof of a greenhouse, certain atmospheric gases absorb or else trap the sunlight i.e. energy from the Sun.

More precisely, about half the light energy reaching Earth's atmosphere passes through the air and clouds to the surface, where it is absorbed and radiated in the form of infrared heat. Most of this heat (~ 90%) is absorbed by atmospheric gases, which we call greenhouse gases (GHGs), and then re-radiated in all directions in the atmosphere warming the Earth. This process is called the natural greenhouse effect and it is beneficial as it maintains favorable living conditions for Earth's microbial, animal and plant inhabitants. Owing to this phenomenon, the Earth is much warmer than it would be without an atmosphere as the heat cannot escape to space , keeping the Earth's average temperature at approximately 15 degrees Celsius.

Naturally occurring GHGs are carbon dioxide, CO₂, methane, CH₄, nitrous oxide, N₂O, ozone, O₃, and water vapour, H₂O.

The atmosphere is important to maintaining heat on the surface of the Earth. Without the naturally occurring GHGs in the atmosphere, Earth's average temperature would be ~ -18 degrees Celsius instead of the ~+15 degrees Celsius it is now.

The Enhanced Greenhouse Effect

Changes observed in Earth's climate, since the mid-20th century, are driven by human activities.

Human activities – particularly burning fossil fuels (coal, oil and natural gas), agriculture and land clearing (e.g. deforestation) – are increasing the concentrations of GHGs in the atmosphere. Human activities do not only increase the naturally occurring GHGs (CO₂, CH₄, N₂O, O₃, H₂O) as previously mentioned but also introduce new chemical compounds that absorb heat in the atmosphere like Chlorofluorocarbons (CFCs) . The higher greenhouse gas concentrations trap more heat in the atmosphere, they act like a blanket insulating the Earth, causing more global warming by increasing the Earth's average temperature and thus enhancing the greenhouse effect.

Since the pre-industrial period, human activities are estimated to have increased Earth's global average temperature by about 1 degree Celsius, a number that is currently increasing by more than 0.2 degrees Celsius per decade. The current global warming trend is unequivocally the result of human activity since the 1950s and is proceeding at an unprecedented rate over millennia.

Section 4: Effects of Climate Change

Fossil fuels – coal, oil and gas – are by far the largest contributor to global climate change, accounting for over 75 per cent of global greenhouse gas emissions and nearly 90 per cent of all carbon dioxide emissions.

As greenhouse gas emissions blanket the Earth, they trap the sun's heat. This leads to global warming and climate change. The world is now warming faster than at any point in recorded history. Warmer temperatures over time are changing weather patterns and disrupting the usual balance of nature. This poses many risks to human beings and all other forms of life on Earth.

Generating power

Causes of Climate Change Based on Various UN Sources **Generating power**

Generating electricity and heat by burning fossil fuels causes a large chunk of global emissions. Most electricity is still

generated by burning coal, oil, or gas, which produces carbon dioxide and nitrous oxide – powerful greenhouse gases that blanket the Earth and trap the sun's heat. Globally, a bit more than a quarter of electricity comes from wind, solar and other renewable sources which, as opposed to fossil fuels, emit little to no greenhouse gases or pollutants into the air.

Manufacturing goods

Manufacturing and industry produce emissions, mostly from burning fossil fuels to produce energy for making things like cement, iron, steel, electronics, plastics, clothes, and other goods.

Mining and other industrial processes also release gases, as does the construction industry. Machines used in the manufacturing process often run on coal, oil, or gas; and some materials, like plastics, are made from chemicals sourced from fossil fuels. The manufacturing industry is one of the largest contributors to greenhouse gas emissions worldwide.

Cutting down forests

Cutting down forests to create farms or pastures, or for other reasons, causes emissions, since trees, when they are cut, release the carbon they have been storing. Each year approximately 12 million hectares of forest are destroyed. Since forests absorb carbon dioxide, destroying them also limits nature's ability to keep emissions out of the atmosphere. Deforestation, together with agriculture and other land use changes, is responsible for roughly a quarter of global greenhouse gas emissions.

Using transportation

Most cars, trucks, ships, and planes run on fossil fuels. That makes transportation a major contributor of greenhouse gases, especially carbon-dioxide emissions. Road vehicles account for the largest part, due to the combustion of petroleum-based products, like gasoline, in internal combustion engines. But emissions from ships and planes continue to grow. Transport accounts for nearly one quarter of global energy-related carbon-dioxide emissions. And trends point to a significant increase in energy use for transport over the coming years.

Producing food

Producing food causes emissions of carbon dioxide, methane, and other greenhouse gases in various ways, including through deforestation and clearing of land for agriculture and grazing, digestion by cows and sheep, the production and use of fertilizers and manure for growing crops, and the use of energy to run farm equipment or fishing boats, usually with fossil fuels. All this makes food production a major contributor to climate change. And greenhouse gas emissions also come from packaging and distributing food.

Powering buildings

Globally, residential and commercial buildings consume over half of all electricity. As they continue to draw on coal, oil, and natural gas for heating and cooling, they emit significant quantities of greenhouse gas emissions. Growing energy demand for heating and cooling, with rising air-conditioner ownership, as well as increased electricity consumption for lighting, appliances, and connected devices, has contributed to a rise in energy-related carbon-dioxide emissions from buildings in recent years.

Consuming too much

Your home and use of power, how you move around, what you eat and how much you throw away all contribute to greenhouse gas emissions. So does the consumption of goods such as clothing, electronics, and plastics. A large chunk of global greenhouse gas emissions are linked to private households. Our lifestyles have a profound impact on our planet. The wealthiest bear the greatest responsibility: the richest 1 per cent of the global population combined account for more greenhouse gas emissions than the poorest 50 per cent.

Effects of Climate Change Based on Various UN Sources **Hotter temperatures**

As greenhouse gas concentrations rise, so does the global surface temperature. The last decade, 2011-2020, is the warmest on record. Since the 1980s, each decade has been warmer

than the previous one. Nearly all land areas are seeing more hot days and heat waves. Higher temperatures increase heat-related illnesses and make working outdoors more difficult. Wildfires start more easily and spread more rapidly when conditions are hotter. Temperatures in the Arctic have warmed at least twice as fast as the global average.

More severe storms

Destructive storms have become more intense and more frequent in many regions. As temperatures rise, more moisture evaporates, which exacerbates extreme rainfall and flooding, causing more destructive storms. The frequency and extent of tropical storms is also affected by the warming ocean. Cyclones, hurricanes, and typhoons feed on warm waters at the ocean surface. Such storms often destroy homes and communities, causing deaths and huge economic losses.

Increased drought

Climate change is changing water availability, making it scarcer in more regions. Global warming exacerbates water shortages in already water-stressed regions and is leading to an increased risk of agricultural droughts affecting crops, and ecological droughts increasing the vulnerability of ecosystems. Droughts can also stir destructive sand and dust storms that can move billions of tons of sand across continents. Deserts are expanding, reducing land for growing food. Many people now face the threat of not having enough water on a regular basis.

A warming, rising ocean

The ocean soaks up most of the heat from global warming. The rate at which the ocean is warming strongly increased over the past two decades, across all depths of the ocean. As the ocean warms, its volume increases since water expands as it gets warmer. Melting ice sheets also cause sea levels to rise, threatening coastal and island communities. In addition, the ocean absorbs carbon dioxide, keeping it from the atmosphere. But more carbon dioxide makes the ocean more acidic, which endangers marine life and coral reefs.

Loss of species

Climate change poses risks to the survival of species on land and in the ocean. These risks increase as temperatures climb. Exacerbated by climate change, the world is losing species at a rate 1,000 times greater than at any other time in recorded human history. One million species are at risk of becoming extinct within the next few decades. Forest fires, extreme weather, and invasive pests and diseases are among many threats related to climate change. Some species will be able to relocate and survive, but others will not.

Not enough food

Changes in the climate and increases in extreme weather events are among the reasons behind a global rise in hunger and poor nutrition. Fisheries, crops, and livestock may be destroyed or become less productive. With the ocean becoming more acidic, marine resources that feed billions of people are at risk. Changes in snow and ice cover in many Arctic regions have disrupted food supplies from herding, hunting, and fishing. Heat stress can diminish water and grasslands for grazing, causing declining crop yields and affecting livestock.

More health risks

Climate change is the single biggest health threat facing humanity. Climate impacts are already harming health, through air pollution, disease, extreme weather events, forced displacement, pressures on mental health, and increased hunger and poor nutrition in places where people cannot grow or find sufficient food. Every year, environmental factors take the lives of around 13 million people. Changing weather patterns are expanding diseases, and extreme weather events increase deaths and make it difficult for health care systems to keep up.

Poverty and displacement

Climate change increases the factors that put and keep people in poverty. Floods may sweep away urban slums, destroying homes and livelihoods. Heat can make it difficult to work in outdoor jobs. Water scarcity may affect crops. Over the

past decade (2010–2019), weather-related events displaced an estimated 23.1 million people on average each year, leaving many more vulnerable to poverty. Most refugees come from countries that are most vulnerable and least ready to adapt to the impacts of climate change.

Section 5: Mitigation and Adaptation

Mitigation – reducing climate change – involves reducing the flow of heat-trapping greenhouse gases into the atmosphere, either by reducing [sources of these gases](#) (for example, the burning of fossil fuels for electricity, heat, or transport) or enhancing the [“sinks” that accumulate and store these gases](#) (such as the oceans, forests, and soil). The goal of mitigation is to avoid significant [human interference with Earth’s climate](#), “stabilize greenhouse gas levels in a timeframe sufficient to allow ecosystems to adapt naturally to climate change, ensure that food production is not threatened, and to enable economic development to proceed in a sustainable manner” (from the [2014 report on Mitigation of Climate Change](#) from the United Nations Intergovernmental Panel on Climate Change, page 4).

Adaptation – adapting to life in a changing climate – involves adjusting to actual or expected future climate. The goal is to reduce our risks from the harmful effects of climate change (like sea-level rise, more intense extreme weather events, or food insecurity). It also includes making the most of any potential beneficial opportunities associated with climate change (for example, longer growing seasons or increased yields in some regions).

Throughout history, people and societies have adjusted to and coped with changes in climate and extremes with varying degrees of success. Climate change (drought in particular) has been at least partly responsible for [the rise and fall of civilizations](#). Earth’s climate has been relatively stable for the past 10,000 years, and this stability has allowed for the development of our modern civilization and agriculture. Our modern life is tailored

to that stable climate and not the much warmer climate of the next thousand-plus years. As our climate changes, we will need to adapt. The faster the climate changes, the more difficult it will be.

While climate change is a global issue, it is felt on a local scale. Local governments are therefore at the frontline of adaptation. Cities and local communities around the world have been focusing on [solving their own climate problems](#). They are working to build flood defenses, plan for heat waves and higher temperatures, install better-draining pavements to deal with floods and stormwater, and improve water storage and use.

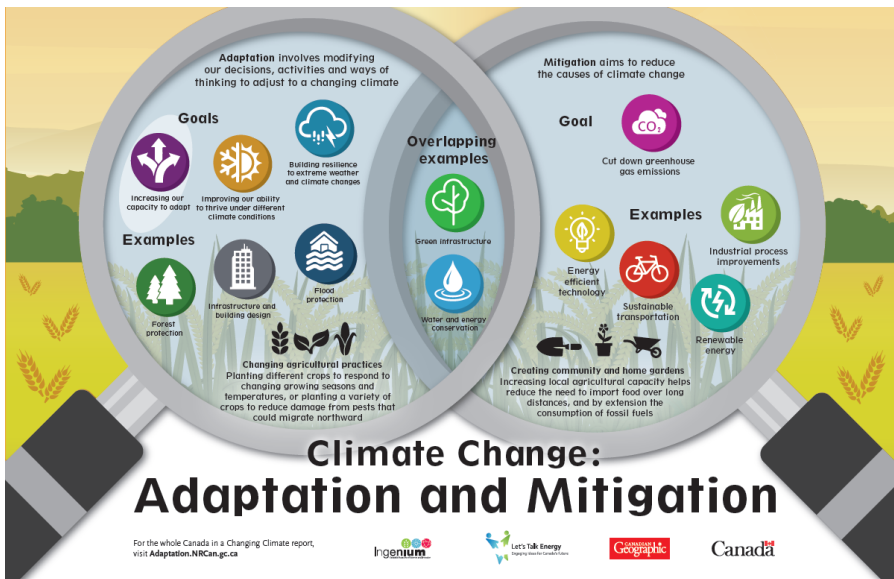


Figure 8 - “Mitigation and Adeptation”, Ingenium.
CLIMATE CHANGE 101

Section 6: Teaching Climate Change

Climate change is the greatest challenge of our times. It is a multi- and interdisciplinary problem closely linked to the natural and social sciences, morals and technology. Understanding and comprehending this complex topic can be difficult for a teacher. Furthermore, there are many challenging questions: How should I approach the topic? How much should I explain? How can I create hope instead of anxiety?

Teacher's Climate Guide helps teachers fill in the knowledge gaps. However, its main target audience is subject teachers and young people instead of children. Teachers familiar with the topic might as well trust their expertise and instincts when talking about climate change in class. Nevertheless, here are some general tips on how to teach children about the changing climate.

Identify your Target Audience

Identifying the target audience is the basic rule of communication. When addressing children, it is crucial to plan the activities according to the age group and receptiveness. For example, teaching through play or drama works well at the primary level, however, it is important to make the message more precise the older the students are.

With the youngest students, it is not necessary to use words like "climate change" or "greenhouse gases". The best way to encourage their connection with nature is to spend time outside (for example, in the school garden or local park), marvel at the natural wonders and do daily environmental good deeds, be they related to climate change or not. Additionally, you might want to observe the weather, discuss differences between weather and climate, read and listen to the stories about the topic or interview grandparents about their winter memories.

From the third grade onwards more conceptual elements can be added, but it is still crucial to encourage children to learn by doing. For instance, you can engage students through activities related to food or composting, which provide a starting point for learning about the carbon cycle. In the fifth

and sixth grade, topics of climate change can be linked to learning about energy production.

Stay Positive

Because of its large scale and complexity, climate change tends to cause anxiety also in adults. Children and young people are good at sensing adults' state of mind and draw their own conclusions. While scientific knowledge on climate change and its impacts is getting more and more accurate and in the face of the media presenting the topic in a threatening light, teachers should stay positive and keep hope alive.

Climate change can be slowed down significantly enough that harmful impacts on humans and the environment are not insurmountable. Although future generations have to cope with climate change, the consequences don't have to be severe if we take prompt action. A growing number of people are constantly joining the fight against global warming. Remember not only to talk about the problems but also about solutions and mitigation.

Teach Environmental Issues Across Subjects

Today environmental issues and their consequences and solutions are hot topics and therefore they need to be discussed in class more than just once or twice a year in biology class. For example, music class can provide an opportunity to review environmental songs or a cycling trip can be combined with learning about the environmental impacts of transportation. In mother tongue and literature classes students can read and write stories about the environment and launch citizen initiatives as an interdisciplinary learning project with visual arts.

Listen to Your Students

Listening and asking questions with curiosity is the best way to find out how much children know about climate change and if their ideas are accurate. The level of knowledge may vary radically from child to child. Children who have discussed the topic with their parents may know a lot about it, whereas other children may have barely heard about it at all.

Listening helps recognize how children feel about climate change. Take emotions seriously, whatever they may be, and encourage children to process them. Creative methods in music, drama, and the visual arts to facilitate processing emotions Creative physical activities can be useful ways to vent fear, anxiety and insecurity.

Encourage Learning through Exploring

Learning through exploring is a good way to encourage students to accumulate knowledge of any given subject. The internet is full of information – and also disinformation – about climate change. For this reason, teachers need to choose appropriate material to prevent misunderstandings and factual distortion. After exploring climate issues together, check the mood in the classroom. Try to stay positive and encouraging.

Avoid Spreading False Information

Climate change is partly linked to other environmental problems, but that doesn't mean that all the environmental issues are connected. To solve the problem, we need get to the bottom of it and find the best solutions. At the primary level, it is not necessary to introduce the causal relationships between social and environmental problems. However, it is crucial to have an understanding of the real facts in order to avoid spreading false ideas.

One of the most common misunderstandings is that the ozone hole caused climate change. Climate change and the ozone hole are related in other ways, but their relationship is so complex and fairly meaningless that it is better to think there is no connection at all. Ozone depletion is an example of a big environmental problem that is being solved through international cooperation and action.

Another common misunderstanding concerns recycling. Although the waste issue is a global problem and more efficient recycling is one method to tackle it, it doesn't play an important part in climate change. Normally packaging contributes only a few percentage points of the products' carbon footprint. Packaging protects goods from damage during transport.

Without it there would be more waste, so in that sense packaging can be good for the environment.

Tell the Truth

We have already shortly discussed how climate change education should be tailored according to the age of the target audience. Another useful guideline is to handle the situation on a case-by-case basis. If a child asks directly about climate change, tell the truth. Climate change is a serious threat, but it can be tackled and a lot of effort is already invested in mitigation and adaptation.

Act Together with Children

Although children are not responsible for solving climate change, they can still play a role in tackling it. Climate action for primary school children can be linked to classroom activities and daily life. However, you might also want to teach them basic skills of active citizenship by writing petitions and/or attending or perhaps organizing a demonstration together. Awareness campaigns initiated and developed by children usually attract media attention. Don't hesitate to contact media if you are planning a campaign, since media visibility boosts efficiency and provides opportunities to practice writing skills (blog, press releases etc.).

Give some Thought on the Impacts of Your Actions

After taking action, it is useful to reflect upon the impacts it has had on your school or municipality. This can also be done at a general level by examining how active citizens have made a difference in your local region. It is important that children learn about causality. Change requires action and action can change the world.

Conclusion

In navigating the complexities of climate change education, the Teacher's Climate Guide serves as a beacon for educators seeking to inspire the next generation of environmentally-conscious citizens. This multi-disciplinary challenge, intertwined with natural and social sciences, morality, and technology, demands careful consideration and an approach that fosters hope over anxiety.

As primary school teachers, you are pivotal in sculpting young minds and nurturing a generation capable of tackling climate change. The guide recognizes the diversity of your classrooms and offers tailored tips to cater to different age groups. From spending time outdoors and marveling at natural wonders with the youngest students to delving into more conceptual elements with older students, the guide provides adaptable strategies.

One fundamental rule of communication is to identify your target audience. By recognizing the receptiveness and age group of your students, you can tailor activities and lessons to make the message both engaging and informative. It's not always necessary to use complex terms like "climate change" with the youngest students; instead, focus on fostering a connection with nature and daily environmental good deeds.

Staying positive is paramount. Despite the scale and complexity of climate change, your positivity can counteract anxiety and instill hope. The guide emphasizes the importance of not just discussing problems but also spotlighting solutions and mitigation efforts. As you teach, remember that you're not just conveying information; you're shaping the attitudes and actions of future environmental stewards.

Furthermore, the guide encourages interdisciplinary teaching, weaving environmental issues into various subjects, making the topic more than a once-a-year discussion. Listening to your students and encouraging them to process emotions through creative methods are essential elements of effective teaching.

Importantly, the guide advises against spreading false

information. Climate change is a complex issue, and it's crucial to stick to the real facts to avoid misunderstandings. Tell the truth, tailoring your response to the age of your audience, and instill in your students a sense of agency. Children may not be responsible for solving climate change, but they can actively participate in its mitigation.

As you embark on this journey of climate change education, remember that change requires action, and action can indeed change the world. The Teacher's Climate Guide is your ally in this endeavor, equipping you with the knowledge and strategies to empower your students and cultivate a generation that embraces the challenges of climate change with courage, determination, and a sense of shared responsibility.

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United Nations. Climate Action. What is Climate Change. Retrieved from <https://www.un.org/en/climatechange/what-is-climate-change>

Further Readings

Learn more from the United Nations

To get familiar with some of the more technical terms used in connection with climate change, consult the Climate Dictionary.

United Nations. The Climate Change Dictionary. Retrieved from <https://climatepromise.undp.org/news-and-stories/climate-dictionary-everyday-guide-climate-change>

Climate change is a hot topic – with myths and falsehoods circulating widely. Find some essential facts at the resource below.

United Nations. The facts on climate and energy. Retrieved from <https://www.un.org/en/climatechange/science/mythbusters>

See the latest [climate reports](#) from the United Nations as well as [climate action facts](#).

United Nations. The science: Climate Action Facts. Retrieved from <https://www.un.org/en/climatechange/science/key-findings>

Causes and Effects.

Fossil fuels are by far the largest contributor to the greenhouse gas emissions that cause climate change, which poses many risks to all forms of life on Earth.

United Nations. Causes and Effects of Climate Change.

Retrieved from <https://www.un.org/en/climatechange/science/key-findings>

Climate Issues.

Learn more about how climate change impacts are felt across different sectors and ecosystems.

United Nations. Transforming climate issues into action.

Retrieved from <https://www.un.org/en/climatechange/science/climate-issues>

European Commision. Climate Action

Find out about what the EU is doing to fight the climate crisis.

European Commission. EU Action. Retrieved from https://climate.ec.europa.eu/eu-action_en

Very useful open educational material is available on the website of the [Climatopia project](#) with which the MIRACLE project has a synergy, in particular:

- Basic Human Needs under the light of Climate Change;
- Self-directed Learning to Improve Quality of Life;
- Learning Activities;
- The Climatopia Educational Kit including the “Climatopia Comic Book” and the “Climatopia Self-Training Handbook”; and
- The Climatopia Simulation and Decision-Making Game.

THE TOOLKIT

includes five booklets

1) **THE BASIC SCIENCE BEHIND CLIMATE CHANGE** aims to empower educators to teach the elements of CC inside and outside their classrooms. It is guided by four principles: contextual relevance, knowledge-based learning, action-oriented learning, and curriculum links. It combines elements from the five types of learning (UNESCO's CCE for SD), the New European Bauhaus initiative; the Council Recommendation on learning for environmental sustainability; and the "GreenComp" to incorporate rigorous scientific knowledge and ethical reflection into CC adaptation and mitigation approaches and measures in small communities.

2) **DIGITAL COMICS CO-CREATION** aims to explore CC through art and digital technology, developing an understanding of the concepts of visual narrative-creating stories with images and words that tell stories in ways that the two cannot say separately.

3) **DIGITAL AUGMENTATION OF COMICS** aims to provide a series of design guidelines to assist teachers and pupils in the development of digitally-augmented print media. With the advances of affordable mobile AR hardware and off the-shelf AR libraries, the focus will shift from technical development to the effects of the technology on pupils.

4) **FAKE NEWS AND DISINFORMATION** discusses a truly global problem, extending beyond the political sphere to all aspects of information, including climate change.

5) **EDUCATIONAL SCENARIOS**, each including Lesson Plans, with hands-on and online activities on co-creation of comics on climate change.



BOOKLET 1

Understanding Climate Change for Primary School Teachers: A Practical Guide

In an era marked by unprecedented environmental challenges, it has become increasingly crucial to instill a deep understanding of climate change in the hearts and minds of our future generations. At the forefront of this educational effort are our dedicated primary school teachers, who play a pivotal role in shaping young minds and nurturing the environmental stewards of tomorrow.

This booklet addresses these issues.