Climate change lesson plan

The climate change lesson plan provides teachers and students with the opportunity to investigate the impact climate change is having on the environment through individual or classroom activities.

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Australian Institute for Disaster Resilience

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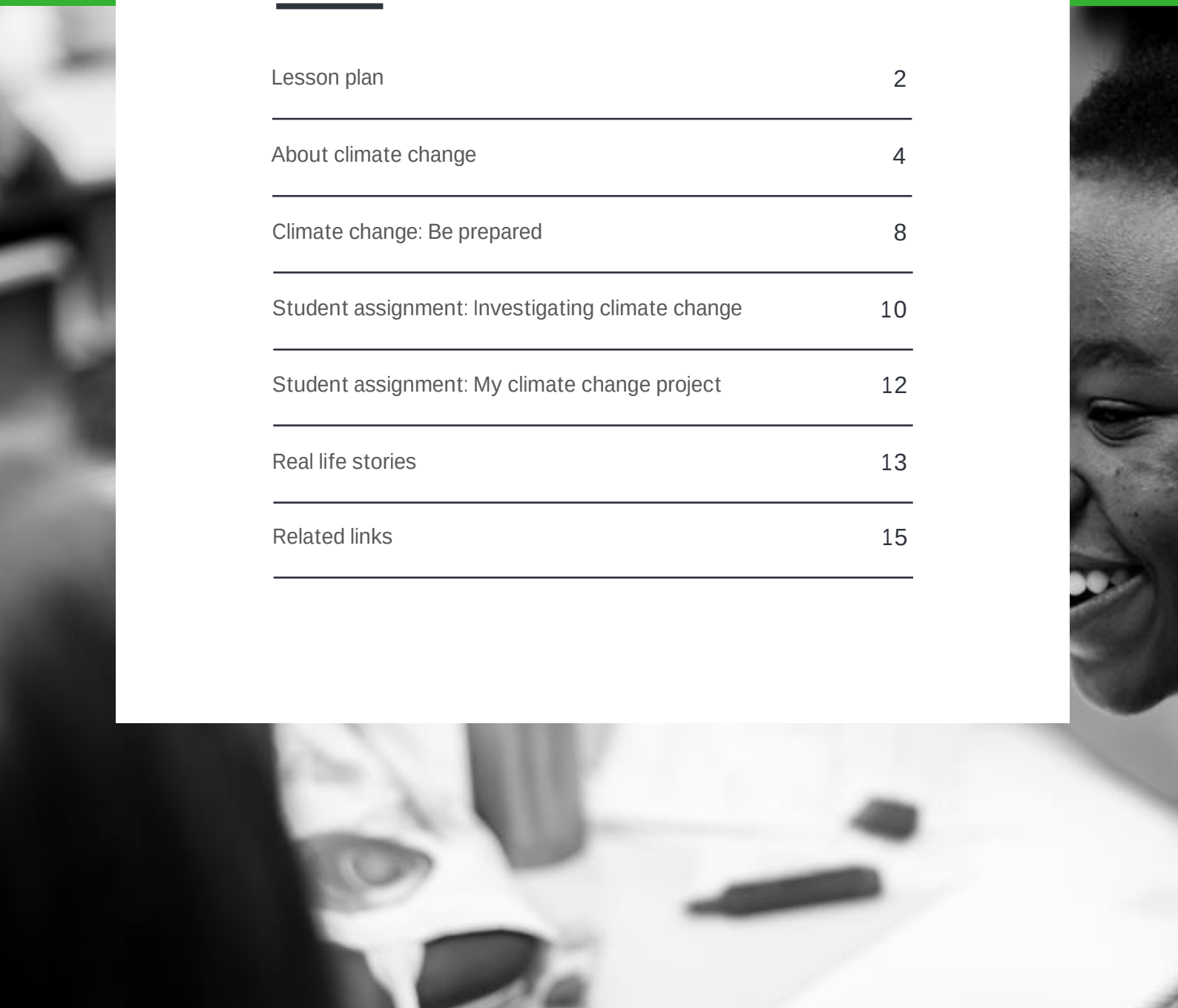

Climate change lesson plan

The climate change lesson plan provides teachers and students with the opportunity to investigate the impact climate change is having on the environment through individual or classroom activities.

Objectives

Participating in this lesson will help students to:

- understand the key concepts of climate change
- develop an awareness and understanding of the effects of climate change.

Required resources

- 'Investigating climate change' activity sheet
- Computers with internet access

LEARNING AREAS

The learning areas for this lesson plan include:

- Geography
- History
- Humanities and Social Science
- Maths
- Science
- Health and physical education
- The Arts
- English
- Technologies.

Lesson steps

Investigating climate change activity

Teachers to explain the following to students:

1. 'Climate change is the result of changes in the weather due to the increases to the earth's average temperature. This is caused by increases in greenhouse gases from activities such as burning fossil fuels, land clearing and intensive agriculture'.

2. Ask students to comment on the following: 'What effect will this rise in temperature have on the Australian climate and environment?' 'How does this affect the people and the land (emotionally, economically and quality of life)?'

3. Teachers can begin to discuss Australia's climate and the impact of increased temperatures. As a class, you can brainstorm how this will impact on the environment in terms of changes in rainfall and rising sea levels.

4. Individually, in pairs, or in small groups, students use the 'Investigating climate change' activity sheet to find out more about climate change.

My climate change project

The students will research greenhouse emissions by using a website and assess their family's ecological footprint. Their research findings can be presented to the class in any of the following formats: a graph or chart; a drawing; a short talk; photographs; a model; or a video.

About climate change

Climate change is the shift in long term weather patterns across the earth. Large parts of the earth have become colder at sometimes and warmer at others.

Climate change

Over thousands of years, the earth's climate changes in response to:

- changes in processes such as solar radiation
- deviations in the earth's orbit
- volcanic activity
- large-scale movements of the earth's crust
- continental drift, and
- changes in greenhouse gas concentrations.

While most of these changes are natural, much of the build-up in greenhouse gases is attributed to human activity.

The earth is surrounded by a layer of gases which insulate the planet by trapping heat from the sun. This is called the 'greenhouse effect' because the gases create an atmosphere similar to that found in a greenhouse. Without these natural gases earth would not be able to sustain life.

These gases are increasing in concentration as a result of practices such as coal burning and overuse of aerosol products. The temperature of the earth has warmed by nearly 1°C over the last 100 years and scientists predict this trend will continue.

Changes in our climate and an increase in extreme weather events are said to be caused by warming of the planet. A warmer earth may lead to changes in rainfall patterns, a rise in sea level, and a wide range of impacts on plants, wildlife, and humans.

First discoveries

The first discoveries that helped explain recent climate change and global warming were in the 18th and 19th centuries:

- In 1753, Joseph Black discovered carbon dioxide.
- In 1827, Jean Baptiste Fourier suggested that an atmospheric effect kept the earth warmer than it would otherwise be - he used the analogy of a greenhouse.
- In 1896, Svante August Arrhenius proposed that carbon dioxide emissions from the burning of coal would increase the earth's greenhouse effect and lead to global warming.

Measuring climate change

From the late 1950s, carbon dioxide (CO_2) measurements were taken on a mountain top in Hawaii. Over the next decade, these measurements confirmed that levels of CO_2 in the atmosphere were rising year after year. In 1967, a computer simulation suggested that global temperatures might increase by more than 1°C, depending on CO_2 levels.

Improved climate models developed over the next 20 years confirmed the link between CO_2 emissions and global warming. Then an ice core from Antarctica revealed a link between carbon dioxide levels and temperature going back more than 100,000 years. The warnings from this evidence encouraged international action on climate change.

During the past 100 years, global average surface temperatures have increased by about 0.75°C. Since 1910, the average temperature in Australia has risen by about 1°C. Although these increases sound small, they have a big impact on the world's climate.

Observations of our past and current climate are essential in assisting us to project future climate, and are critical in our understanding of both climate variability and the drivers of climate change.

Rainfall, temperature, sea levels and snow cover are the key indicators of climate trends.

Impacts of climate change

Climate change is one of the greatest social, economic and environmental challenges of our time. Human activity contributes significantly to climate change. This, in turn, is having an impact on Australia's:

- rainfall
- temperature
- bushfire frequency
- cyclone frequency
- health (of both humans and animals)
- heritage
- biodiversity.

These changes will affect current and future generations.

Global warming and climate change

The terms 'global warming' and 'climate change' are sometimes confused with each other, but there is a difference. Global warming is the gradual increase in the earth's average surface temperature due to greenhouse gases in the atmosphere, whereas climate change refers to the long-term changes in climate, including average temperature and rainfall.

Greenhouse gases

Greenhouse gases have always been a natural and necessary part of the atmosphere. The chemical properties of greenhouse gases mean that they strongly absorb and re-radiate the sun's warmth in the atmosphere. Because of this process, the earth's temperature is 33°C warmer than it would otherwise be, allowing life on earth to exist.

Water vapour is the most abundant greenhouse gas. The concentration of water vapour is highly variable and human activities have little direct impact on the amount of it in the atmosphere. The main greenhouse gases generated by human activity are carbon dioxide (CO2), methane and nitrous oxide. There are also manufactured gases such as chlorofluorocarbons (CFCs), halocarbons and some of their replacements that make a small contribution to global warming.

Over the last 800,000 years, the amount of carbon dioxide in the atmosphere has varied between approximately 172 and 300 parts per million (ppm). Since the 1700s, carbon dioxide levels have risen

sharply to about 386 ppm. The extra carbon dioxide is largely responsible for the increase in global temperatures of about 0.75°C.

How will Australia be affected?

It is difficult to precisely predict what the impacts of climate change will be, as they vary with each region. The best estimates we have predict that by 2030 parts of Australia will face:

- a further 1°C of warming in temperatures
- up to 20 per cent more months of drought
- up to 25 per cent more days of very high or extreme fire danger
- increases in storm surges and severe weather events.

Australia is vulnerable to the effects of climate change. We are already the driest inhabited continent on earth, and are exposed to the dangers of extreme heat and drought. We are also home to many globally important and vulnerable ecological systems. Australians are overwhelmingly coastal dwellers. Our industries and urban centres face ongoing water limitations. Our economy, including food production and agriculture is under stress.

How will I be affected?

As an individual, you may find your home more exposed to extreme weather events, your food may be less plentiful, or your water will be more restricted and provided from recycled sources. You will also need to be aware of sustainably caring for our land and marine environments.

Climate change: Be prepared

While we cannot prepare for climate change as we can for other disasters, we can take some steps to protect ourselves and our families through specific actions.

As individuals, we need to be aware that we can make decisions that contribute to future climate change. We can contribute to climate change through greenhouse gas emissions. For example, our families may contribute to climate change through personal decisions about where to live and how to get to work or school, through our choice of appliances and patterns of water use.

Whether we know it or not, we constantly make decisions that both contribute to climate change and that will be influenced by climate change. Successfully adapting to future climate change will require an understanding of its causes and likely impacts. As individuals, we can have an impact on policymakers' decisions that relate to climate change by becoming informed and engaged in the issue.

Gathering information

The first step in taking action is to be informed. An understanding of the phenomena is required to help us make decisions and recognise the choices that we have. Many websites produced by state governments and others provide information about the causes, impacts, and responses to climate change.

Become engaged in your community

Being informed can lead to taking action. There may be increases in the cost of electricity or homeowners' insurance rates. Many homes and businesses are located in areas that will be prone to floods in the future. How will increased summer heat affect poor and elderly urban populations? There is often little that individuals can do in response to these projected impacts, but they can demand that urban policy makers take a long term view and recognise the need to plan ahead so that communities are prepared to meet the challenges posed by climate change.

Individuals can inform others about climate impacts through conversations, letter writing, attending community board meetings, and voting. What each of us does as an individual becomes amplified when we engage others in the discussion and persuade them that there is a need for a careful, reasoned response to the impacts of current and future climate change and variability.

STUDENT ASSIGNMENT

Investigating climate change

Student name: . . . . . Date / /

Find answers to the following (you may work individually, in pairs or in groups):

1. What is climate change?

2. What is the difference between climate change and global warming?

3. During the past 100 years what has been the average global temperature increase?

4. What has been the average temperature rise in Australia since the middle of the twentieth century?

5. Why is the absorption of CO2 in the ocean harmful to coral?

6. How much did the global average sea level increase between 1870 and 2007?

7. What is the biggest source of greenhouse pollution?

8. How are greenhouse gases warming up the planet?

STUDENT ASSIGNMENT

My climate change project

An ecological footprint can be defined as the total set of greenhouse gas emissions caused by an organisation, event, product or person.

Find out how much you and your family contribute to greenhouse emissions by assessing what your ecological footprint is. You can calculate your ecological footprint by visiting http://www.footprintnetwork.org/resources/footprint-calculator

Present the results of your ecological footprint to the rest of the class using one of the following:

- a graph or chart
- a drawing
- a short talk
- photographs
- a model
- a video.

THE PROJECT ON THIS PAGE WILL HELP YOU DISCOVER:

- what an ecological footprint is
- how to assess your ecological footprint.

Real life climate change stories

A shift in temperatures resulting from climate change is likely to have serious impacts on environments in Australia, including a potential increase in the incidence of wildfires and other natural disasters.

Research has suggested that a temperature rise of only 10Â°C would threaten a number of alpine species currently living at the upper limit of their temperature range. Over 54 per cent of the entire extent of the Australian Alps bioregion is within New South Wales, of which more than 80 per cent is within the New South Wales park system (NSW NPWS 2003a).

Alpine vegetation within Kosciuszko National Park, L. Wren / DEC

Climate change poses one of the greatest potential threats to the values of Kosciuszko National Park. In the Australian Alps, Bureau of Meteorology records suggest there has been a warming of the alpine climate (mean annual temperature) over the past decade of between 0.1 and 0.15Â°C.

The Commonwealth Scientific and Industrial Research Organisation (CSIRO) has modelled alpine climate change scenarios suggesting a decrease in the area of snow cover (of at least 30 days per year) by 14-54 per cent by 2020 and by 30-93 per cent by 2050 (CSIRO 2003). The worst-case scenario could see a contraction of the snow country to a small area centred on Mount Kosciuszko by 2050, and the possible loss of the alpine ecosystems.

Some of the potential effects of climate change on the biota of the park, especially the alpine and subalpine areas include:

- the possible extinction of between 15 and 40 of the 200 alpine plant species within 70 years, with a further 49 species likely to experience reductions in their distributions. As little as a 1Â°C rise in temperature accompanied by the predicted changes to precipitation would eliminate the bioclimatic range of the mountain pygmy-possum (Burramys parvus)
- the uphill migration of biota from lower elevations, although those from higher elevations are likely to be lost because there is no alternative habitat
- changes in the size and composition of some vegetation communities
- changes in the composition of the faunal assemblages
- a likely increase in the diversity, abundance and distribution of weed species
- uphill extensions in the ranges of pest animal species
- alterations to catchment hydrology and geomorphological processes.

Source: Managing pressures on the park system, NSW Government – Department of Environment & Heritage, accessed on 5 September 2012.

Related links

Australian Conservation Foundation
https://www.acf.org.au/think_global_act_local_on_climate_change

Bureau of Meteorology
http://www.bom.gov.au/climate/change/#tabs=Tracker&tracker=timeseries

CSIRO
https://www.csiro.au/en/Research/OandA/Areas/Assessing-our-climate/Climate-change-QA/What

Department of the Environment and Energy
http://www.environment.gov.au/climate-change

/ End.

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