

Name: _____

Junior Science

Ecology and the Environment

Downloadable Resource



Tina Youngman

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Making a Food Web



Cut around the following name and pictures to build your own food web. Remember to layout a draft food web first before gluing them permanently onto page 14 of your workbook.



Pollution



Pollution is defined as **contaminants** that enter the environment and cause damage or negative changes. Pollution can include chemicals such as oil, CFC's, radioactive compounds or even energy like heat, light and sound. These contaminants are referred to as **pollutants**. There are many different kinds of pollution and three key ones are outlined below.

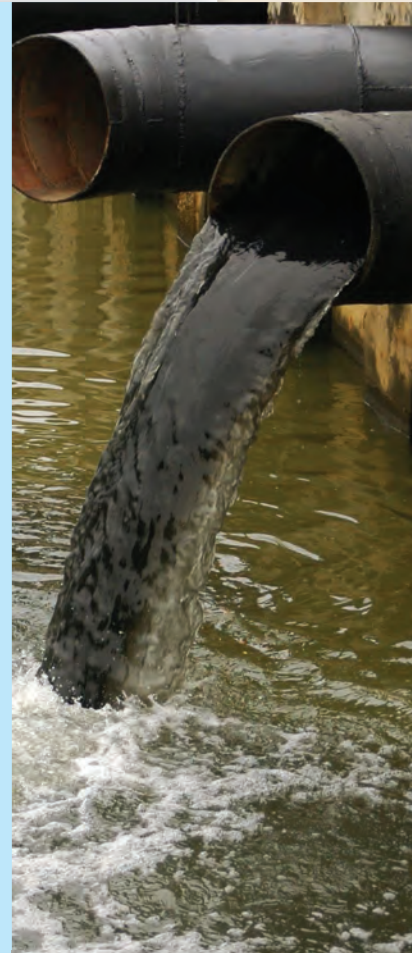
Air Pollution

This is when **particulates** or other harmful materials are released into the atmosphere. Our atmosphere is vital to the survival of all living things and is what makes our planet **habitable**. It has been estimated that seven million people die each year from air pollution related illness and disease. As well as death, air pollution also causes breathing difficulties, heart disease, asthma, stroke and lung cancer. Air pollution also affects plants and animal growth, and can destroy habitats through the production of acid rain. **Smog** is a combination of soot, smoke and sulfur dioxide mainly from vehicles, burning fossil fuels and factory fumes. Not only this but it can form ground level ozone which is quite toxic to all living organisms. This combination of **emissions** creates a thick smoky fog that covers cities and contributes to the major health problems stated above. Air pollution is a worldwide issue as it is common for the toxic particulates to be produced in one place but be shifted by the winds to another location and create smog or acid rain. Some countries have very strict rules and guidelines about air pollution but still suffer its effects because of what the neighbouring countries are doing. Air pollution leads to **global warming** and the **greenhouse effect** as well as the destruction of the **ozone layer**. Air pollution from vehicles and factories (that burn fossil fuels) comes in the form of sulfur dioxide and nitrogen oxides that mix with water in the atmosphere and produce acid rain. This in turn damages plants, animals and pollutes waterways. CFC's (which are prohibited) from air conditioners, aerosol cans and refrigeration systems, all cause damage to the ozone layer in the **stratosphere**. This area is responsible for reducing the amount of damaging **UV radiation** that makes it to the Earth's surface and would otherwise be harmful to all life on Earth.



Water Pollution

When waterways and water storage areas (like lakes, oceans and underground **reservoirs**) are contaminated with pollutants, it can pose many hazards to all living things. It affects not only the organisms living in the water but all **ecosystems**. It has been calculated that around 14000 people die daily from the effects of polluted water. Millions of people don't have access to clean drinking water in many countries across the world. The water becomes polluted from numerous sources such as **sewage** treatment plants, farm **runoff**, storm water from urban areas and roadways. Common contaminants include oil, faeces, detergents, fertilisers, **pesticides**, **herbicides**, litter and **decaying** organisms. It isn't only chemicals that pose a risk to humans but also **pathogens** like bacteria and single-celled organisms. An example of this is the parasite **Giardia** which causes severe diarrhoea. Even an excess of sediment is classed as pollution. These sediments are increased in areas where trees have been felled and land cleared for building. If rivers are full of sediments (dirt, silt, clay and sand) then the **turbidity** (cloudiness) of the water is increased and this prevents light from entering. When light can't get in, water plants and the animals that rely on those plants can't survive. Farms and other agricultural industries can create large amounts of pollution through runoff. When rain water runs off paddocks and orchards it takes fertilisers with it which enter waterways. This runoff can contain excessive amounts of **nitrogenous fertilisers**, herbicides, pesticides and phosphates which can kill aquatic life. The introduction of large amounts of nutrients (like nitrogen) can cause massive blooms of algae which again increases the turbidity. Rubbish has a major effect on waterways and the life in them. When people drop litter it washes into storm drains or rivers and passes into the oceans which poses a risk to wildlife. For example, fish and birds mistake plastic bags for jellyfish, eat them then feel full with having gained any nutrients. They don't break down, become lodged in the animals gut and they starve to death. The amount of litter in our oceans is ridiculous. Large garbage islands have been found with the largest in the Pacific Ocean estimated to be 700 000 km² in size. This island is composed of some large litter like drums or bottles but is mainly pieces of plastic that have been broken apart in the oceans and form a plastic **suspension** floating below the surface.



Land Pollution

When the soil is contaminated with chemicals from agriculture, improper waste disposal or factories, it has far reaching effects. Chemicals and sewage within the soil can **leach** into waterways and destroy habitats. Not only this but they can inhibit plant growth, kill necessary insects and cause disease in humans. Soil pollution affects all food chains, as it harms the producers responsible for creating the first step in the energy cycle. Rubbish dumps (landfills) are a major source of pollution. Not only do they look horrible but they also severely damage the soil and chemicals released from the trash leaches into waterways damaging them as well. Many electrical products like televisions and computers that are put into landfills, release **heavy metals** like lead and mercury which are very harmful to all living things. As rubbish **decomposes** in the landfills massive amounts of methane are released which contributes to global warming and the greenhouse effect.



While these three types of pollution are the main focus of the article, the table below outlines some other forms of pollution, their pollutants, sources and effects.

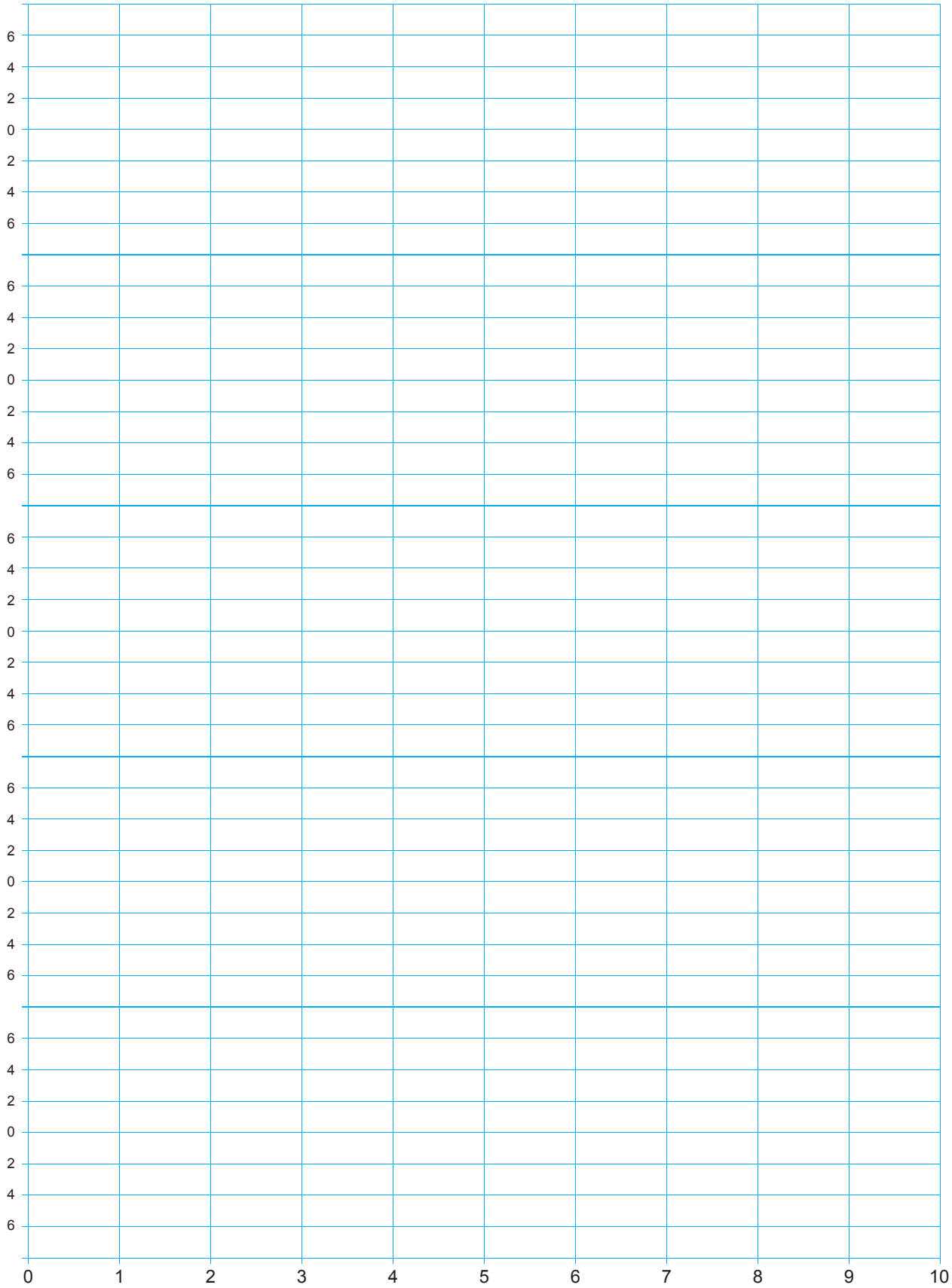
Pollution Type	Pollutants	Sources	Effects
light pollution	light energy	Cities, stadiums and motorways.	Light trespass and interference with astronomical sights.
noise pollution	sound energy	Motorways, airports and factories.	Damage hearing in all animals. Affect animal communication and ability to find prey or avoid predators.
visual pollution	Signs, power lines, rubbish and destroyed natural landscape.	Urban areas, mines, forestry and factories.	Destroys views and looks unappealing.
radioactive contamination	radioactive compounds	Bombs and power plants.	Land becomes unusable. Can cause mutations and death in living things.
thermal pollution	cooled or heated waste water	Power plants, paper mills, mining plants, oil refineries and urban areas.	Alters temperature of water, decreases amounts of dissolved oxygen and can cause increased algae growth.



Drawing Kite Diagrams



Kite Diagram Showing the Numbers of Five Different Species Along a Rocky Shore





The Pukeko



Pukeko are very common New Zealand birds. They can be seen alongside roads, in creeks and streams and at **urban** park areas. They are found throughout New Zealand and are one of the most widespread birds and are easily recognisable by their **iridescent** purple body feathers, long orange legs and bright red front shield and beak. On average they are 40 cm in height and 1 kg in mass but males are usually slightly larger than females. Pukeko have long legs, long finger-like toes and large feet; these all help them to walk across swampy wetlands and stops them from sinking into muddy ground or streams when looking for food. While they have large black feathered wings they rarely fly, preferring to wade in the water, swim and run. When they do fly it is very clumsy looking and is usually for only short distances. Like most birds they have many features that enable them to fly which include: hollow bones to make them lighter, large wing muscles (around 15% of their body's mass) and they get fresh air when they inhale and exhale plus they have high **respiratory** rates which allows them to get more oxygen to release more energy.

Pukeko prefer to live in open areas rather than tree-filled spaces. They have spread rapidly and numbers ballooned with the removal of forests for **agricultural pastureland**. Pukeko feed on the ground mainly eating grasses and young plants and the shape of their beak makes it ideal for tearing **foliage**. They also eat frogs, insects, eggs, fish, small mammals (like mice) and other birds (like ducklings). The **pancreas** produces **enzymes** that helps them break down their food and release the **nutrients**. This is more effective than many mammals because they don't have teeth to start the **digestive** process off. A human's **bile** is **alkaline** to help **neutralise** the stomach acid but a bird's is acidic, which aids the breaking down of food. Pukeko don't have a bladder so they don't urinate. Instead they have runny faeces which contain **uric acid** made by the kidneys. In comparison, humans produce urine in the kidneys which removes the same waste product of urea from the body.

During the breeding season, they feed their chicks on other animals as they are a protein-rich food source that helps them to grow quickly. They form groups and live together to raise their young and defend their territory. The Pukeko mate and lay their eggs (up to 6 each) in a **communal** nest (that can take up to 18 eggs) where they share the jobs associated with raising the young including: sitting on the eggs, defending the chicks, feeding the chicks and protecting the nest area. Pukeko eggs are light tan with brown speckles which helps them to camouflage into their ground nests which are formed in flattened grasses or reeds. After hatching, the chicks are fed for two months by the adults. They are very different in colouring to the adults and it isn't until around three months of age and adult size that they develop the **iconic** violet plumage and **radiant** red beaks. As youngsters they have dull grey-black feathers and grey legs, beaks and face shields to identify them as young so the adults don't fight them. It makes them less aggressive looking. Adult pukeko are quite **aggressive** and will fight any invaders to their area which includes pulling the heads off ducklings to prevent the duck population from increasing which would add extra competition for food. Pukeko use a variety of calls to mean different things. A loud shriek is used to warn off predators, small yips are used between adults and chicks and deeper hoarse calls when fighting each other. They also communicate using their white under-tail feathers which they flick when disturbed to warn other members of the group. When a neighbouring group of Pukeko invades their space they make lots of loud shrieks, flick their tail feathers, puff their chests up, show off their beaks and face shields and if necessary bite and kick. Pukeko have very few predators and are mainly attacked and killed by hawks when young. As adults, they will attack predators and have been seen biting and kicking cats and stoats, especially when the nest or chicks are threatened.





Pests and Weeds



Eat the honeydew produced in beech forests that is a food source for many native birds. Exist in massive numbers that eat a massive amount of food such as native insects.

Compete with native plants and don't provide berries or nectar for native birds, needles cover the floor and stop undergrowth from growing.

Feed on young plants and seedlings on the forest floor which changes the structure of the forest and destroys habitats of many animals and insects.

Grows rapidly in most areas, covering the ground in dense patches. Shades areas which prevents native plants from growing and its spiky structure makes it hard to remove.

Compete with cows and sheep for grass, carry tuberculosis and their burrows cause large amounts of erosion that destroys paddocks and damages the fringes of bush land.

Grows rapidly in shallow fresh water and shades other plants so they die, also clogs the waterways which slows the flow of water which worsens the water quality.

Eat the new growth of tall trees and destroy the forest canopy which shades areas below. Eat native bird's eggs and compete with birds for nesting areas. Also carry the disease tuberculosis.

The main reason many birds have become extinct and why Kiwi numbers are so low. They eat the young birds as well as lizards and frogs.

When they feed they muddy the water and destroy native water plants as well as the habitats of many water insects. They eat native fish eggs and strip streams and rivers of all life.

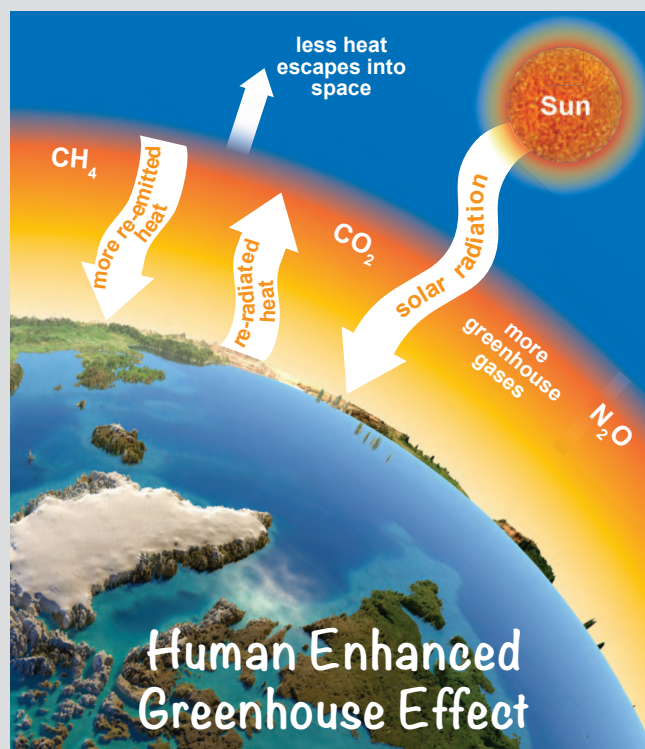
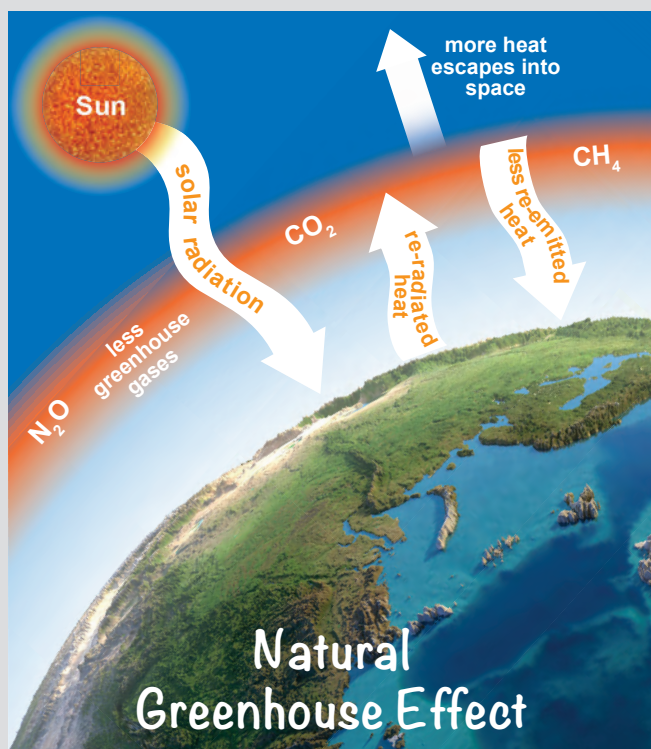


Planet Earth is in Peril



Climate change is more than just global warming. It is changes in the rate and location of all types of weather **phenomenon** over a long period of time (millions of years). This rules out short term changes like **El Nino** (which results in increased temperatures and a greater number of cyclones over a few years). Changes include the amounts of wind and rain, length of the seasons and the frequency of extreme events like floods, droughts and cyclones. Climate change can occur on a small local scale or on a large global scale. Causes of climate change include volcanic eruptions, quantity of light and heat from the Sun and movement of the Earth's **tectonic plates**. In more recent history, human's use of **combustion** of fossil fuels has come to have more and more effect. Because it is a change over millions of years, scientists have been busy establishing what the climate would have been like millions of years ago so that comparisons can be made. Climate change isn't just our Earth getting hotter, it is also when it cools down like during an ice age. There is an ice age expected in another 500 000 years.

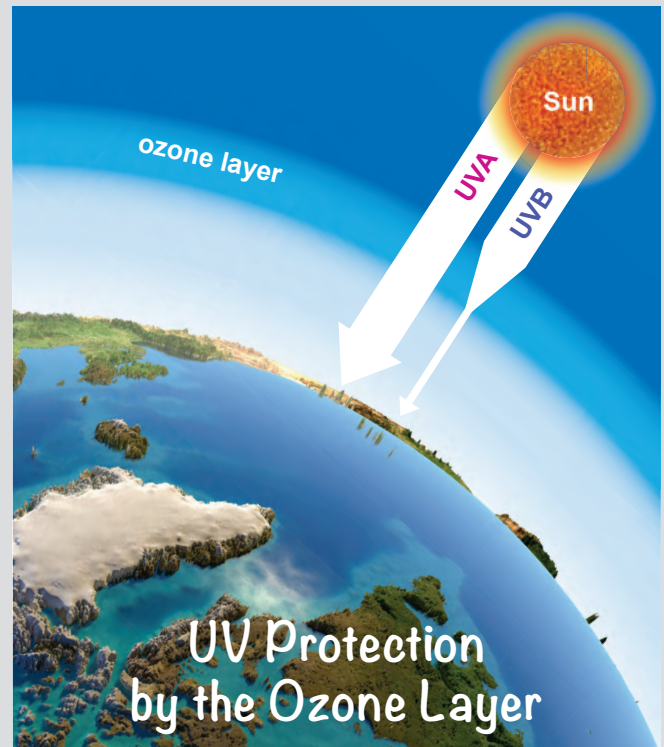
The greenhouse effect is caused by greenhouse gases. If you think of a greenhouse (used to grow plants) it is a building usually made of glass that allows heat energy to enter but limits how much exits. This causes the air to warm up and gives the inside of the greenhouse a consistently warm temperature. The greenhouse effect is similar to this as it results in the warming of the Earth's atmosphere. It is a natural process that is actually very important to life on Earth, because it allows our planet to have a constant warm temperature which promotes life. In fact, if we had no atmosphere (or greenhouse gases) the average surface temperature would be around -20°C , far too cold for life and liquid water. Due to the presence of the atmosphere and how it **re-emits** the **radiated** heat energy, it creates an average temperature of 15°C which is perfect for life. However, because of increased amounts of the greenhouse gases like CO_2 , methane, water vapour and ozone, the greenhouse effect is **exacerbated**. CO_2 gases are produced by burning fossil fuels including the combustion that occurs in vehicle engines. As well as this, the clearing of forests is also a contributing factor. The thicker atmosphere caused by the increase in gases results in heat energy bouncing around inside the atmosphere heating the Earth more and more. Since the 1800s, CO_2 has increased by over 40% and since the 1900s the temperature has increased by around 1°C . While this may seem insignificant, it is enough to cause global warming.



Global warming is a gradual increase in temperature of the Earth's surface, atmosphere and waterways. It is predicted to be a permanent change, they can't easily be reversed. It has been estimated that by the end of this century the Earth's average temperature would have increased by 5°C . There is real evidence that our Earth is warming up and at an ever increasing rate. The sea levels are rising, ice areas are melting, recorded temperatures have been increasing and there have been dramatic

changes in plant and animal species. Causes of global warming include increases in greenhouse gases and deposits of heat absorbing soot particles. The effects of global warming are already being seen with the retreat of glaciers, **extinction** of species and sea levels rising to cover low lying islands.

The ozone layer in the **stratosphere** is composed of ozone (O_3). Ozone absorbs dangerous **UV radiation** emitted from the Sun. In fact it absorbs around 98% of UVB radiation that would otherwise damage living things. When UV light hits ozone it splits the O_3 into O_2 and O which then react together to form O_3 again. UV light is harmful because it causes cancers, damages the skin and eyes, reduces the numbers of **plankton** (small photosynthesising organisms) in the oceans and harms plants. Some chemicals produced by humans destroy the ozone and cause thin or weak spots in the ozone layer. This is referred to as an ozone hole. These thinner areas allow higher levels of UV radiation to enter and so life below can be harmed. There is a large ozone hole over Antarctica which affects New Zealand and is a key reason why it is extra important to use sunscreen and prevent sunburn in our country. These chemicals include CFCs (**chlorofluorocarbon** compounds), **aerosol can propellants** and **freons**. These chemicals were commonly used in refrigeration, aerosol cans and air conditioners. In 1989, a worldwide agreement was created banning the use of such ozone **depleting** chemicals as CFCs. This has caused the amounts of ozone to become stabilised and the weak spots aren't increasing in size. Even though CFC use has been greatly reduced, some countries don't abide by the rule and are still using them and it has also been revealed that nitrous oxide compounds like those from car engines also damage the ozone.



Deforestation is the removal of large areas of trees (usually by burning) in order to make the land underneath available for other uses where the trees won't be replaced. This has mainly been for **agriculture, horticulture** and establishment of towns and cities. While this harms the ecosystem of the forest it also has more global effects. Plants perform **photosynthesis** which removes CO_2 (a greenhouse gas) from the atmosphere and so reduces the effects of global warming. As well as no longer being able to remove CO_2 , the burning of the forests to clear them makes CO_2 with estimates that 20% of the total CO_2 production is from deforestation.

Human overpopulation is when the number of people in an area exceeds how many people the area can support. This can create numerous issues including:

- Decline in water quality.
- Depletion of natural resources (such as fossil fuels).
- Increase in pollution.
- Increase in deforestation for clear land to build homes on.
- Increase in CO_2 **emissions** → increase in the greenhouse effect → increase in global warming.
- Increase in **poverty** and because of this, deaths of young children.
- Increase in disease spreading.
- Decreased **life expectancy**.
- Increases in wars.

As can be seen from the information above, our Earth is in peril! This is mainly due to humans and the advancements in our society has created such a range of negative impacts. It's time that we all start making a change, even if it is just as small as turning off the tap while brushing our teeth or switching off the wall socket for our phone chargers when they aren't in use.



Renewable and Non-Renewable Fuels



Hi, my name is Margo Mayweather and I work for Enviroearth.com – the number one environment based website in the world today. I am going to be interviewing Pete Swamp from the Non-renewable Fuels Association (NRFA) and Theresa Green from Only Renewable Fuels (ORF). Why don't you two introduce yourselves?



I'm Pete from NRFA and we represent the oil, coal, natural gas and nuclear energy industries. These groups all provide energy sources that aren't replenished quickly and will run out.



I'm Theresa and I'm the branch speaker for ORF. We are all about using renewable fuel sources like wind, hydro, solar, geothermal, biogas and biomass. We love Mother Earth.



Thanks for that. My first question is for Pete: Can you tell me why non-renewable fuels are so good?



Of course I can, there are plenty of reasons:

- They are quite easy to extract and transport all over the globe.
- They produce good amounts of energy for things like electricity production.
- They provide money and jobs to many nations around the world.
- Factories and transport are already set up to use these types of sources.



That's all very 'positive' Pete but what about the fact that they are running out rapidly, take millions of years to regenerate, cause massive amounts of pollution, increase the CO₂ emissions, contribute to global warming AND when they are extracted our beautiful Earth is damaged!



Ok, well I see there are two sides to every source. Theresa what actually are renewable fuels?



They are the only way to save Mother Earth!



That's all very well, but you haven't answered my question. Can you define what they are in one sentence?



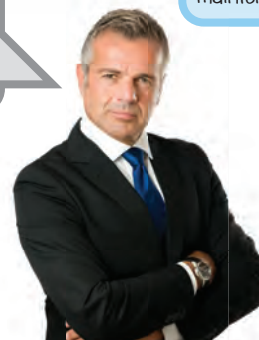
Sure...they are energy sources that can be used over and over again and aren't depleted when used



Excellent, thank you. Any other reasons why they are so good?



Excuse me but they are very expensive and people only care about money these days!



That's so not true Pete! While they cost money to set up, in the long term they are cheaper because the plants that use them require less maintenance.



6

What about when it's cloudy or the wind isn't blowing, people want reliability not some pish-posh greenie hoopla!



Pete, while it's true, that's not a major issue because there are some awesome batteries out there that store the energy when the winds are up or the Sun is shining.

7

This is all very interesting. Any other positives, or negatives for that matter, about your fuel types?



I would have to say that renewable sources don't make as much energy as non-renewable sources BUT the technology is improving and like with anything new it takes time to develop a perfect efficient system. Bearing in mind that humans have been using fossil fuels like coal for hundreds of years.



8

See, even she admits that non-renewable sources are better. They're more reliable, efficient and cheaper. Clearly they are far superior to your fluffy little windmills or shiny solar panels.



Just remember Pete, your sources are running out. Even though you disagree with ORF and its ideals you have to admit that we need alternatives to coal, oil and uranium. If we all used a little less energy then the renewable sources would easily provide enough for us all.

9

You may be right, but if we used less energy then the non-renewable sources would last longer anyway and we wouldn't need to waste money finding or developing new sources!



Well I think a major advantage of renewable sources is the way they treat Mother Earth! They don't pollute her, they don't have to be mined from the ground, forests don't have to be removed, they don't produce massive amounts of CO₂ and they also provide money to local economies. Not only that, individual people can have renewable sources at their house; it's a bit hard to have a coal mine in your back yard!

10

That's all we have time for today, thank you both very much, you've given us plenty to think about. This is Margo Mayweather for Enviroearth.com signing out.

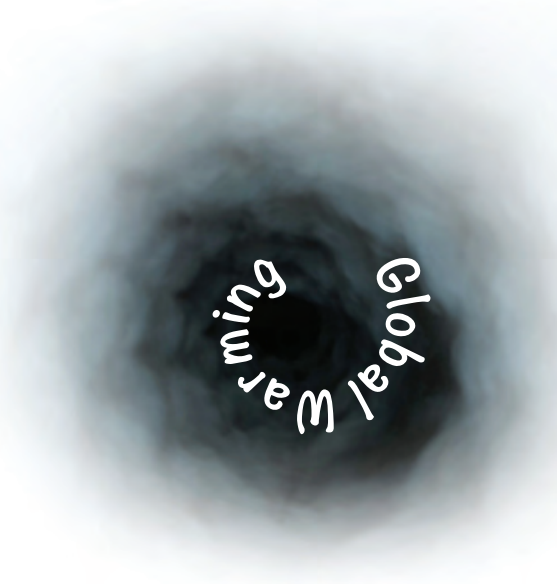




Word Games

1. Terminology Tornado

Using the following science term, see how many words of 3 or more letters you can make in 10 minutes.



Points
 3-4 letters = 1 point
 5+ letters = 2 points

Scores
 0-5 points = awful
 6-10 = average
 10+ = amazing

2. Six Word Scramble

Use the clues to work out what the 6 key science words are and then spell the word in the grid by colouring in the squares that make up the word. Use different colours for each answer.

EAR	HE	HIC	BI
EDS	TR	NIC	BA
OM	CL	RIA	OP
CTE	ASS	WE	NU

Clues

- a. Mass of living things at each feeding level. (7) _____
- b. A feeding level is called a ? level. (7) _____
- c. Adaptations, feeding and habitat. (5) _____
- d. Plants that grow where they aren't wanted. (5) _____
- e. Important organisms involved in the nitrogen cycle. (8) _____
- f. A type of non-renewable fuel. (7) _____

3. Block Buster

Cross out each of the words that fit with one of the clues. You will be left with one word that doesn't fit; this is your answer.

parasite	introduce pests	transpiration	global warming	biogas	carnivore
geothermal	producer	runoff	evaporation	deforestation	melting
waves	soil nitrates	scavenger	climate change	wind	omnivore
herbivore	acid rain	solar	ozone hole	seepage	absorption

Clues

- a. Renewable fuels and energy sources.
- b. Negative ways humans are impacting the Earth.
- c. Feeding types and ways organisms get energy.
- d. Parts of the water cycle.

Answer

4. Topic Word Find

There are 14 words related to the carbon cycle hidden in the word find, use the clues below to help you locate them.



Clue	Answer
CO ₂	
Made from dead plants and animals.	
How CO ₂ gets from the atmosphere into the oceans.	
A major man-made CO ₂ producer.	
Producers that remove CO ₂ from the atmosphere.	
How animals release energy from food.	
Carbon is stored inside the bodies of all living _____.	
Organisms that break down dead things, this process is called _____.	
Scientific word for burning.	
How CO ₂ gets from magma back into the atmosphere.	
Major storage area of dissolved CO ₂ .	
Process plants carry out that uses CO ₂ from the atmosphere to make food.	
Area where gaseous CO ₂ is at its highest since 1800 AD.	
Carbon is an example of a _____ and the carbon cycle is an example of a _____ cycle.	