young people's trust for the environment
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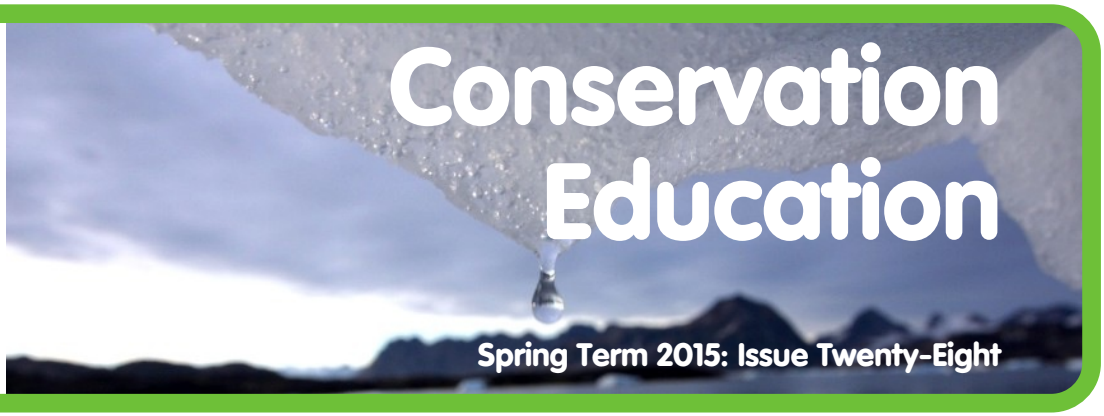

Conservation Education

Spring Term 2015: Issue Twenty-Eight

Published by the
Young People's Trust for the Environment
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ISSN 1756 - 9087

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Climate Change Update

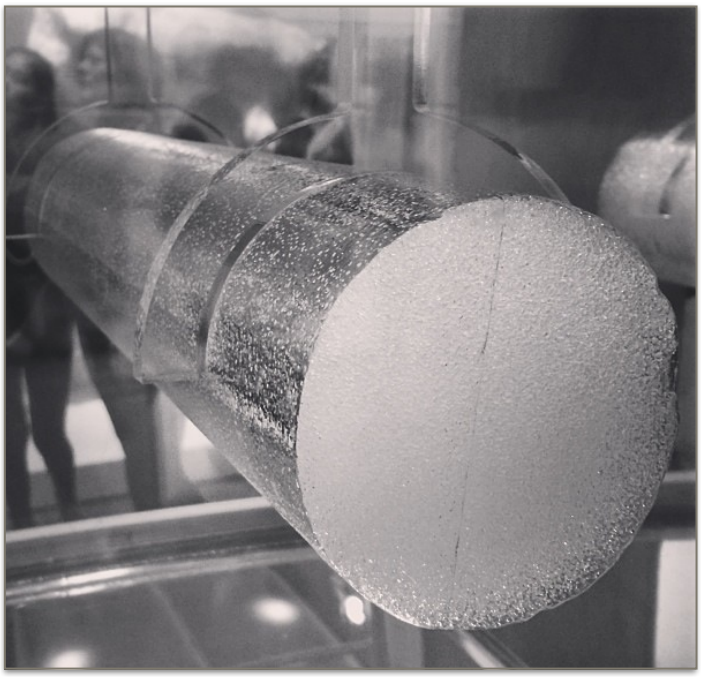
The last time Conservation Education looked at the subject of climate change was in 2006. In the last nine years, like the climate, some of the thinking on climate change has been developed and changed. As a result, we thought it would be worth taking another look at this really important topic. It is possibly the most important issue facing humans on planet Earth at the moment, as if we don't make changes ourselves, we could end up facing enormous challenges in the future.

What is climate change anyway?

Firstly, let's have a think about what climate change actually is. The definition hasn't changed. **Weather** is what it's doing when you go out for a walk or look out of the window - for example, is it sunny, raining, cloudy, foggy etc. **Climate** is the pattern of weather over a long period of time - years or even decades. The world's climate is always changing, but the changes tend to happen over hundreds of years. The reasons for climate change are really complicated and range from changes in the balance of gases in our atmosphere to factors like a massive event on the sun, to the growth of microscopic creatures in the oceans. They interact with each other in very complex ways. However, despite the complexities, almost all scientists who study the world's climate patterns looking back thousands of years are now in agreement that our world's climate is changing faster than it has ever done before. What is more, almost all of them agree that the reason that the climate is changing so fast is us humans.

How can scientists know what the climate was like?

You might struggle to remember what the weather was like last week, so how on earth are scientists able to say what the climate was like thousands of years ago? Well, they are able to use a special drill to pull out cylinders of ice (**ice cores**) from deep within the ice sheets of really cold places like Greenland and Antarctica. The ice in the cores contains bubbles of air, which can be analysed to show what the atmosphere was like at a given time in history or prehistory. In Greenland, the ice can tell us about climate up to 123,000 years ago, whilst in Antarctica the ice can reveal details about the makeup of our planet's atmosphere up to 800,000 years ago!



Above: An Arctic ice core sample. Air bubbles can clearly be seen in the ice. Photo by Stefan Leijon

Banner photo by: klem@s

How can this be anything to do with me?

You might be wondering what you have done to cause the planet's climate to change. After all, you are just one person - how can the problem be anything to do with you? Well, the answer is that we have all had our little part to play in causing climate change, and it hasn't just been down to today's humans, but to everyone who has been alive since the start of the **Industrial Revolution** in the 1760s.

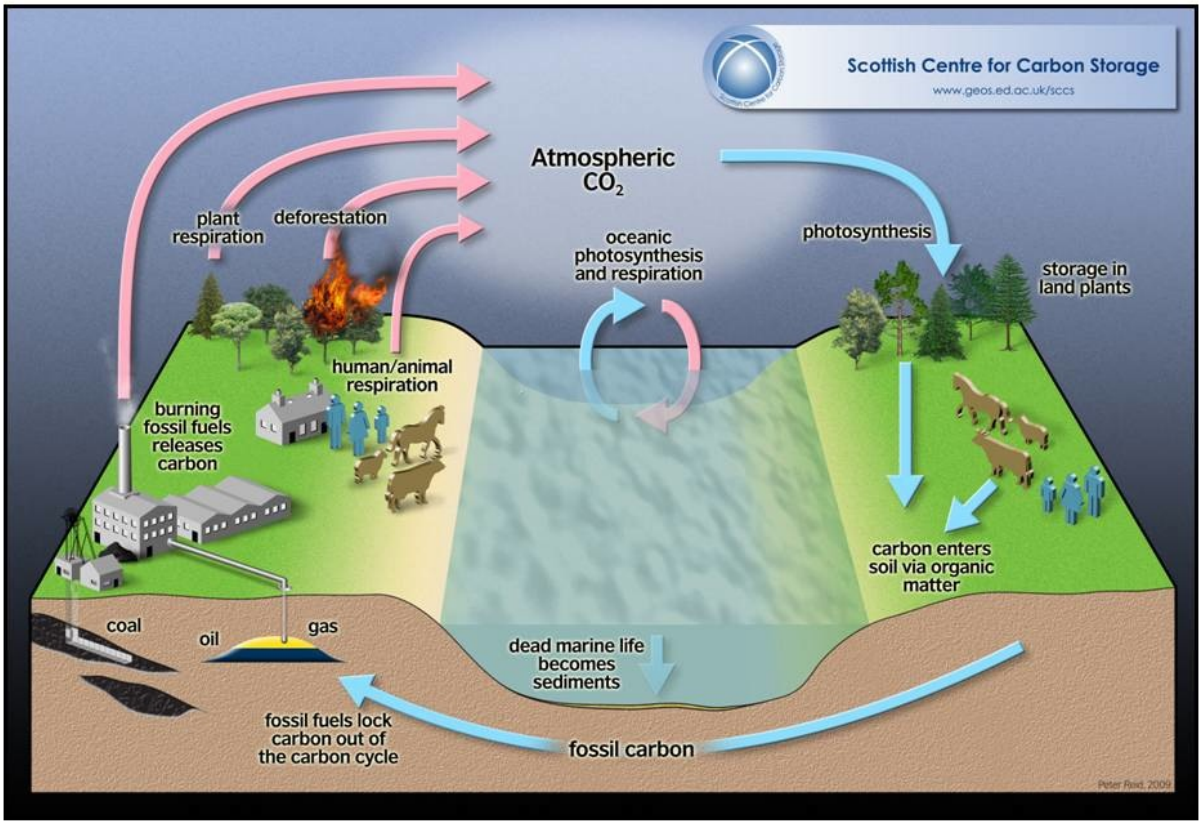
Ever since that time, humans have invented more and more clever machines to do work for them. And now technology moves on incredibly quickly. Believe it or not, in 1998, less than 10% of UK homes had an internet connection. In 2014, that had increased to 84%. Meanwhile, in the year 2000 only 50% of adults in the UK owned or used a mobile phone. By 2014, that had grown to 93% and numbers are still increasing! All of these new gadgets that we now own and take for granted need energy to work. Much of the electricity we use every day is still made in power stations that burn fossil fuels - coal, gas or oil to produce the electricity. And of course, every time you get in the car or bus, take a train or a plane, it is likely to be burning fuel derived from oil and putting more carbon dioxide into the atmosphere.

Why are they called 'fossil' fuels?

Around 165 million years ago, vast numbers of little animals and plants called plankton lived in the world's oceans. They are still living in the oceans today. But lots and lots of plankton that were living in the oceans all those millions of years ago died and sank to the bottom of the ocean. They were covered over with silt, crushed by immense forces and over the course of millions of years, they turned into the thick black sludgy stuff buried under our planet's surface that we call crude oil. So oil is a kind of black gloopy fossil.

The same kind of thing happened in huge forests covering the land millions of years ago. The trees died, fell, were covered over and turned over millions of years into the black burnable rocks we know as coal. Natural gas was formed when layers of dead plants and animals were exposed to intense pressure and heat over millions of years. It can also be formed more quickly deep down in marshes, bogs and even landfill sites!

So why is it a problem that we're burning all these old plants and animals from millions of years ago? Well, all living things contain quite a lot of a substance called carbon. Plants, while they are alive absorb a gas called **carbon dioxide** (**CO2**), which they combine with sunlight and water to create starch, which provides the energy for them to live and grow. When they die and rot away, they release the carbon contained in themselves slowly and naturally back into the atmosphere. This process is called the **carbon cycle**.



Left: This diagram provides a simplified visualisation of the carbon cycle.

Provided by the Scottish Centre for Carbon Storage.

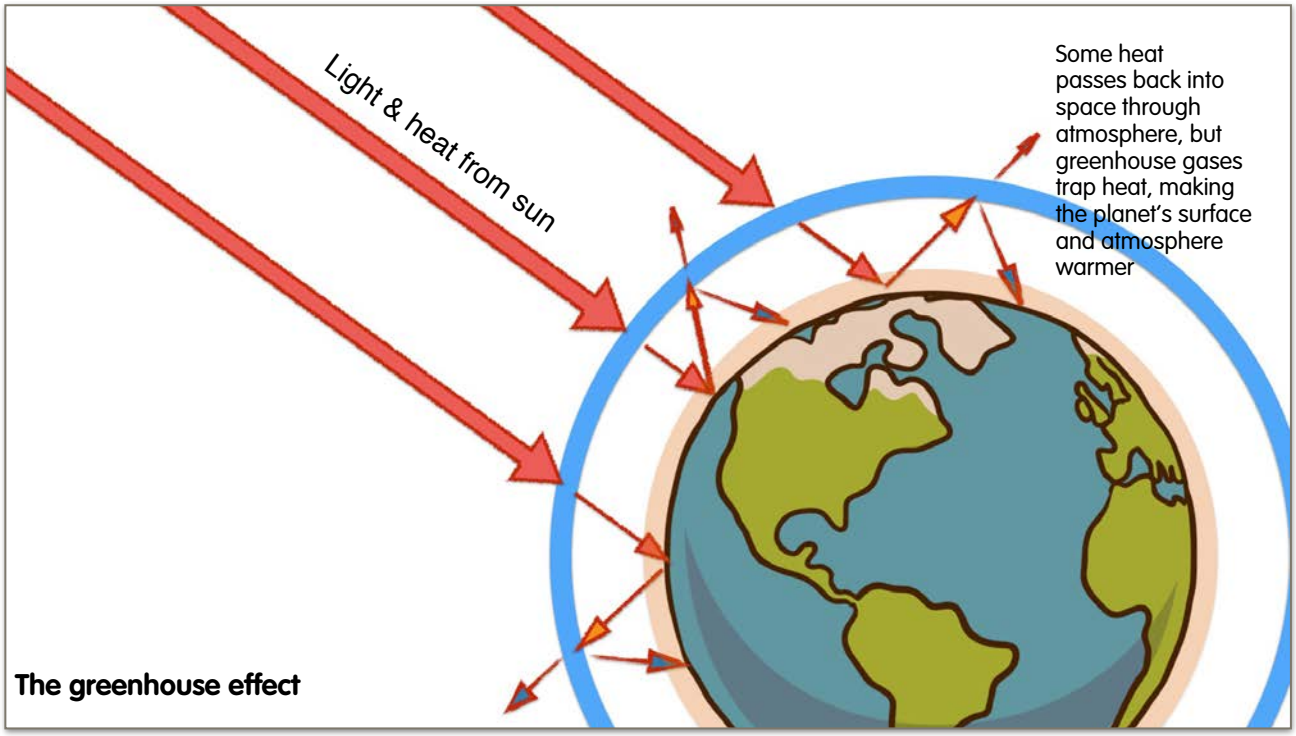
Each year, animals and **microbes** (really small life forms) between them emit about 220 billion tonnes of CO2 into the atmosphere. Plants emit CO2 at night when they can't photosynthesise, and this adds about another 220 billion tonnes to the atmosphere each year. But those plants absorb about 440 billion tonnes of carbon dioxide through photosynthesis each year, so this is all balanced out. Parts of the oceans will be emitting CO2 (around 330 billion tonnes per year), but this is balanced out by other parts of the oceans, which will absorb about 330 billion tonnes of CO2 each year. So in nature, the balance of gases in the planet's atmosphere remains similar from year to year.

The carbon contained in fossil fuels was buried before it could be released back into the atmosphere, so it has been locked away for millions of years. By burning fossil fuels, we are releasing that carbon back into the atmosphere in the form of carbon dioxide. So we are adding huge amounts (about 32.3 billion tonnes in 2014) of extra carbon dioxide into

the atmosphere each year. About 40% of this extra carbon dioxide can still be absorbed by nature via the carbon cycle, but the other 60% ends up in the atmosphere, and that is upsetting the planet's ability to maintain a steady level of carbon dioxide in the atmosphere. In fact, carbon dioxide levels remained at between 180 and 300 parts per million in the Earth's atmosphere for the last 500,000 years. But in the last couple of centuries, the level of carbon dioxide has increased to 380 parts per million.

Carbon dioxide and the greenhouse effect

'So', you may think, 'there's more carbon dioxide in the atmosphere. We can't see it, we can't smell it, why's that a problem?'. Well, it is a problem because carbon dioxide is a '**greenhouse gas**' As it builds up in the atmosphere, it helps to trap more and more of the heat energy that the sun fires at our planet every day, a bit like wrapping the Earth in a blanket, or building a greenhouse around it. So as we make the blanket thicker, we increase the amount of heat that is held in our planet's atmosphere, and gradually the planet gets hotter. You can find a video about how the greenhouse effect works here **https://ypte.org.uk/videos/the-greenhouse-effect.**



The greenhouse effect

Carbon dioxide isn't the only greenhouse gas, others include methane, nitrous oxide, ozone and water vapour. Carbon dioxide is the second most abundant greenhouse gas in the atmosphere - water vapour is the biggest component. The trouble is that the planet gets warmer because we increase the amount of carbon dioxide in the atmosphere by burning more fossil fuels. The increased heat means that more water evaporates from the oceans, so there is more water vapour in the atmosphere, which means the greenhouse effect gets stronger, which means the planet gets warmer, which means there is more water vapour in the atmosphere, and so on…

Since 1900, the planet has warmed up by about 0.8 degrees Centigrade, but by 2100, the temperature increase could be a further 2-5 degrees Centigrade. The last time the planet warmed by 5 degrees, it took 5,000 years and brought us out of the Ice Age. If left unstopped, we could create the same amount of warming in about 100 years!

Could climate change be a good thing?

While almost all scientists agree that climate change is definitely happening and that this is a bad thing not only for humans, but for the animal and plant life with which we share the planet, some think that climate change might not be such a bad thing. One example is Professor Richard Tol of Sussex University. His 2009 study on the effects of climate change found that viewed planet-wide, it would actually be a good thing until about 2080.


Photo by Martin Fisch

The benefits are small and have been felt more by rich countries than poor ones. It seems pretty much certain that after 2080, climate change would have negative impacts, but until then, the positives include less human deaths in winter - cold winters kill far more people than summer heat waves do, either in the UK or even Greece!

Meanwhile, increased levels of atmospheric carbon dioxide have actually been good for plants. A study of satellite data from the last 30 years by Dr Ranga Myengi of Boston University has found that 31% of areas covered in vegetation have become greener, while only 3% have become less green. This means that a 14% increase in the productivity of vegetation has been seen across a range of global ecosystems.

So climate change could actually be a good thing, at least for another 60 years, according to some scientists. They are currently very much in the minority. This does not necessarily mean that they are wrong. However, even they agree that after 2080, unchecked climate change will definitely be a bad thing. The big challenge for humanity is that the climate is a bit like a fire that you might light in your fireplace (if you have one) at home. The fire gets going and it's nice and cosy. To keep the fire going, you throw on more logs now and then and maybe it starts to get too hot. When you stop adding logs, the fire doesn't immediately stop burning and while it's still burning the room is still hot and for a while might still be getting hotter. The world's climate is like that fireplace, but on a much bigger scale. Even if we cut our emissions of greenhouse gases right now, today, it would be decades before the planet stopped warming up, which is why tackling climate change is an urgent problem for us all now.

Above: An example of better protection - flood-proofed homes in Bangladesh
Photo by Climate Change, Agriculture & Flood Security

Why climate change is probably a bad thing

Climate change is such an important issue that the United Nations has assembled a huge panel of thousands of climate experts from around the world. The **Intergovernmental Panel on Climate Change** (**IPCC**) provides the world's governments with predictions on what will happen and what needs to be done now to prevent climate change causing catastrophic problems for our planet in the future. The latest IPCC Report, published in 2014, provides almost total agreement that humans are causing climate change.

The Report states that our actions are warming the oceans and atmosphere, sea levels are rising as snow cover melts along with Arctic sea ice, which will threaten coastal areas and low-lying communities and cities. As oceans absorb more and more carbon dioxide from the atmosphere, they are becoming more acidic, which will cause loss of coral and big changes for many marine species. Extreme weather like storms, heavy rainfall, droughts and heat waves are very likely to increase. Unless action is taken, we may not be able to grow enough food to feed everyone and a lack of water in some areas may cause mass migration and even wars.

Above: With increased ocean temperatures and acicdification, sensitive coral is dying. This coral should be colourful, but it is all white because it has died in a process called 'bleaching'.
Photo by Silke Baron

Even with action, because the world's fireplace is already burning, we will still need to adapt to some of the changes to climate that are already unavoidable.

While extreme weather seems to be in the news all the time, a study by independent scholar Indur Goklany has found that in fact the number of human deaths from floods, droughts and storms has dropped by 98% since the 1920s. He argues that this is not because the weather events are any less dangerous, it's because we are much better at forecasting, giving people time to get out of the way before the bad weather hits and because we are investing more as a species in better protection against storms, floods and droughts. As countries become steadily richer, he believes protection against extreme weather will continue to improve too.

Those adaptations are being seen by some as an opportunity to make the world a more robust and secure place for our future. As Dr Chris Field said "If we're dumb, it's a serious, serious problem and if we are smart it's a serious problem, but one that we can manage".

The problem is already here

In recent years, we have seen Typhoon Haiyan hit the Philippines in 2013, superstorm Sandy hit New York, New Jersey and other states in 2012, while Hurricane Katrina hit New Orleans back in 2005, causing widespread devastation. Closer to home, the flooding experienced in parts of the UK and Europe in the winter of 2013-14 followed drought in the summer of 2012. The World Resources Institute shows that globally, there are already 21 million people at risk of flooding while damage caused by flooding costs almost £65 billion per year. By 2030, the Institute estimates that 54 million people will be at risk of flooding, with repair and prevention costs totalling £340 billion.

On 13 and 14 March 2015, Cyclone Pam struck the 85 islands making up the Pacific Island nation of Vanuatu with terrifying force and winds in excess of 189mph. 90% of the housing in the capital, Port Vila has suffered damage. The main reason that the human death toll was not higher was that Vanuatu was well prepared for such an event.

In fact, Port Vila is the city most at risk of natural disaster according to the Natural Hazards Risk Atlas and its government had built cyclone evacuation centres in readiness, but nothing could stop the destructive force of the cyclone from destroying the houses, cutting off power to the capital's hospital and closing all of the schools.

Left: The ruined remains of a house at Ipota, Vanuatu in the aftermath of Cyclone Pam. Much of the housing in Vanuatu has suffered the same fate, leaving over 100,000 of the islanders homeless. Vanuatu has a total population of 267,000 people.
Photo taken on 18 March 2015 by European Commission DG ECHO

We also need to remember that climate change does not just affect humans. In fact, we are much less vulnerable than many animal and plant species that will simply be unable to adapt in time to changes to their habitats that a changing climate will bring. They have the ability to adapt, but this usually happens over hundreds, or even thousands of years. The speed of the climate change that we are likely to be causing means that in the next 100 years, there will be huge changes to the climates of many ecosystems. Adaptation to changes that occur at that speed is very rare for animals and plants. You can read more about the effects of climate change on wildlife here **https://ypte.org.uk/downloads/conservation-education-21-wildlife-and-climate-change**.

What do we need to do?

One thing is certain: no individual or even nation acting on its own can make much difference. We all share this planet and we need to do what we have previously failed to do for most of the time. That is, to act together to face up to the challenge of climate change, to make changes to the way we live our lives and to adapt our countries to be better protected against the climate change that is already happening. In December 2015, the **United Nations Framework Convention on Climate Change** will hold talks in Paris to attempt to get nations to agree to binding targets to reduce emissions of carbon dioxide and other greenhouse gases.

Above: Droughts will become more frequent with climate change. Photo by Bert Kaufmann

The **European Union** has pledged to cut its emissions by 40% of the levels emitted in 1990 by the year 2030. The **USA** has announced emissions reductions of 26-28% of 2005 levels by 2025. **China**, now the world's biggest greenhouse gas emitter has pledged to end increases in its carbon dioxide emissions by 2030. More recently, Zheng Guogang, the head of China's Weather Bureau has warned that his country faces serious problems from climate change already, with more floods, droughts and extreme weather as a result of temperature increases that are double the global average. Meanwhile, Chinese Vice Premier Zhang Gaoli has made pledges to develop green energy sources to replace its coal-fired power stations. This is all good news, but other fast-developing economies like **India** and **Brazil** will also have to make commitments for real results to be achieved. Recent estimates suggest that otherwise, India, Brazil and the rest of the world will be producing 34 billion tonnes of CO_2 per year - more than the 22 billion tonnes the EU, USA and China are predicted to be emitting by then if their current pledges become reality.

How can we cut our carbon dioxide emissions?

The answer to this is simple - we need to burn less fossil fuels. But making the change - '**decarbonising**' our way of life and adopting CO2-free **renewable** energy generation on a wide scale is going to be a huge challenge for the next generation at least. The technologies to harness renewable energies - **wind, solar, tidal, biomass** and **wave energies** to name but a few are developing fast.

In another encouraging development, the UK government has just announced that the 70% fall in the cost of solar panels in recent years has caused it to revise its estimates for the contribution to electricity generation made by solar energy. They now think that 14 Gigawatts of energy will be generated by solar power (4% of the UK's requirement) by 2020, up from 5 Gigawatts at the end of 2014. You can find out more about renewable energies here **https://ypte.org.uk/downloads/conservation-education-19-alternative-energies.**

Above: We need more renewables like wind power (top left) and solar power (top right) and need to be less reliant on fossil fuels like coal (bottom left) and natural gas (bottom right).

Making the change to renewables is not going to be a question of flicking a switch. For example, 80% of the UK's homes have gas central heating and only 2.3% of cars sold in the UK in 2014 were hybrids, electric or alternatively-fuelled. That means that 97.7% of new cars sold in the UK in 2014 run on petrol or diesel. Change is slowly coming though, as 56% more alternatively fuelled vehicles were registered in September 2014 than in the same month the previous year. Real change will have to happen at government level though. Recent developments, including restricting the power consumption of new vacuum cleaners sold in Europe and the ending of sales of conventional 100 watt bulbs may seem small changes, but as more and more of these restrictions are imposed by governments across the world, we will start to have increasingly meaningful reductions in our carbon dioxide emissions.

Above: Electric cars like this one are becoming more common on the UK's roads, but the majority of drivers still opt for petrol or diesel-powered cars.
Photo by Ian Halsey MMXIV

What can I do to help?

We have to hope that governments now and in the future are able to show the leadership needed to create the conditions to restrict climate change. But you can make lots of small differences every day.

- Turn off lights, TVs, hi fis and other electrical equipment when when they are not in use.
- Be careful with water.
- Think about walking or cycling for short journeys and use public transport if possible.
- Make sure you have low energy lights in your house and find out if it could be better insulated.
- Ask your parents to turn down the heating by one degree.
- You could also learn about renewable energy and maybe even persuade your parents to look at the possible benefits of fitting solar panels to your house!

Photo montage above: Top left, Floods on the Somerset levels in November 2012, photo by Mark Robinson; **top right**, aerial view of flooding in Pakistan in August 2012 that affected over 800,000 people, photo by Department for International Development UK; **bottom left,** Marsworth Top Lock on the Grand Union Canal, almost empty of water because of drought in February 2012, photo by Snapshooter46; **bottom right**, the dried out bed of Emigrant Lake Oregon, photo by Al Case.

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Registered charity number 1153740
Published March 2015

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