Climate Change and Animals

This presentation will explore the impact of climate change on animals around the world, using research by ZSL's scientists as case studies, as well highlighting ways in which individuals can make a difference.

How to use:

- Click through the slides one by one.

- Write down your answers to any **QUESTIONS** on a blank piece of paper before clicking through to see the answers at the end.

- Research the answer to any question you're unsure about or words you don't recognise.

Q1. What does ZSL stand for and what do they do?

Q1. True or False?

Global warming is caused by there being greenhouse gases in the earth's atmosphere.

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The Natural Greenhouse Effect
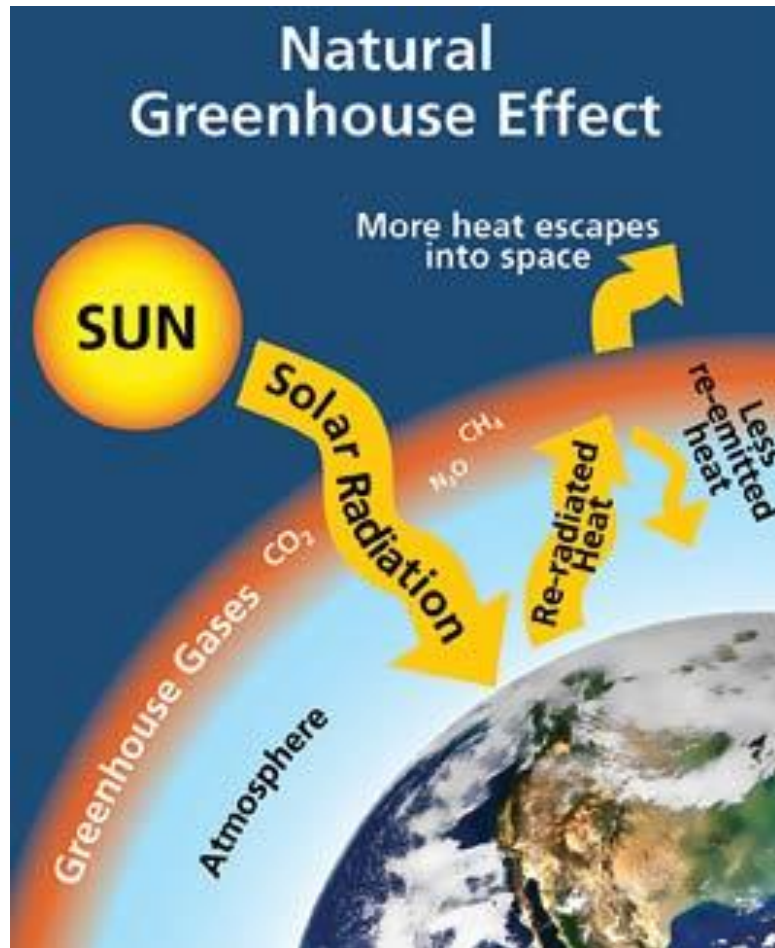
As a planet we need the natural greenhouse effect.

A large part of the sun's radiation is re-radiated by the earth as heat. Greenhouse gases in the atmosphere stop all this heat from being lost in space, keeping the planet at an average temperature of 15 degrees Celsius.

Without this, the global temperature would be -18 degrees Celsius – too cold for life as we know it.

Q2. Can you name three greenhouse gases?

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The Human Enhanced Greenhouse Effect

However, human activities are putting more of these gases into the atmosphere.

This enhanced greenhouse effect is meaning that more reradiated heat is being trapped, and the global temperature is increasing.
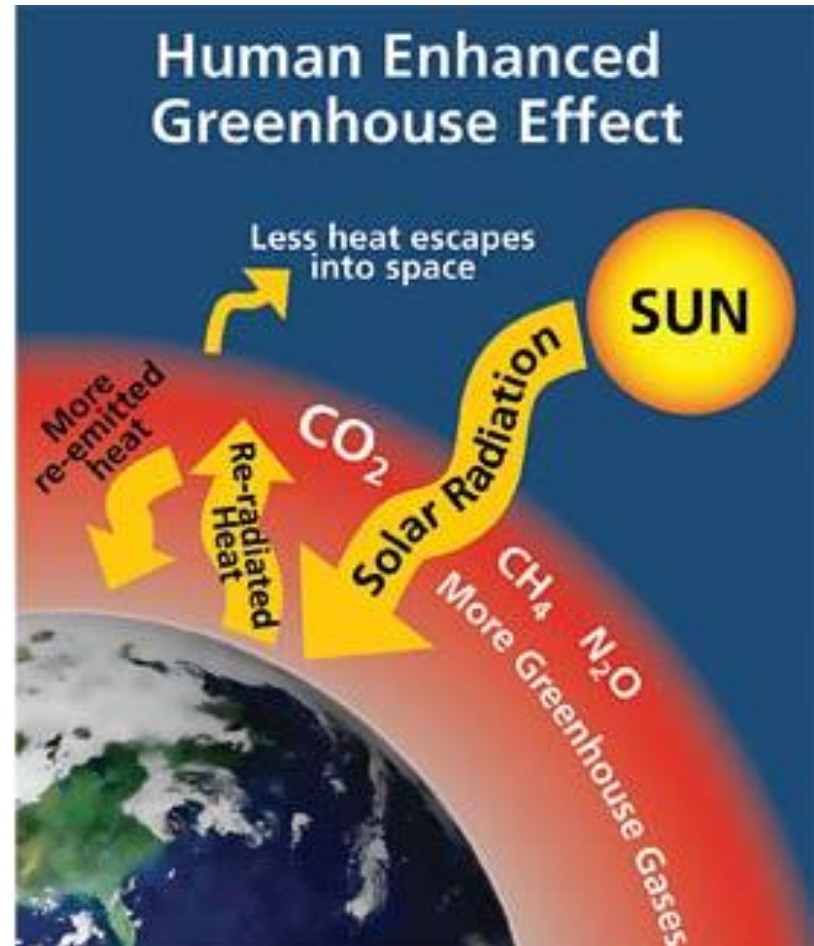
Greenhouse Gases

Q3. Using the below pictures as inspiration, can you think of four sources of greenhouse gases?

As well as contributing to increased greenhouse gases in the atmosphere, humans also affect climate by changing the nature of the land surfaces (for example by clearing forests for farming) and through the emission of pollutants that affect the amount and type of particles in the atmosphere.

Q4. True or False?

Climate Change is the same as global warming

Q5. True or False?

One day's weather can tell us if climate change is happening

Climate vs. weather

Key

- Polar
- Temperate
- Arid
- Tropical
- Mediterranean
- Mountains
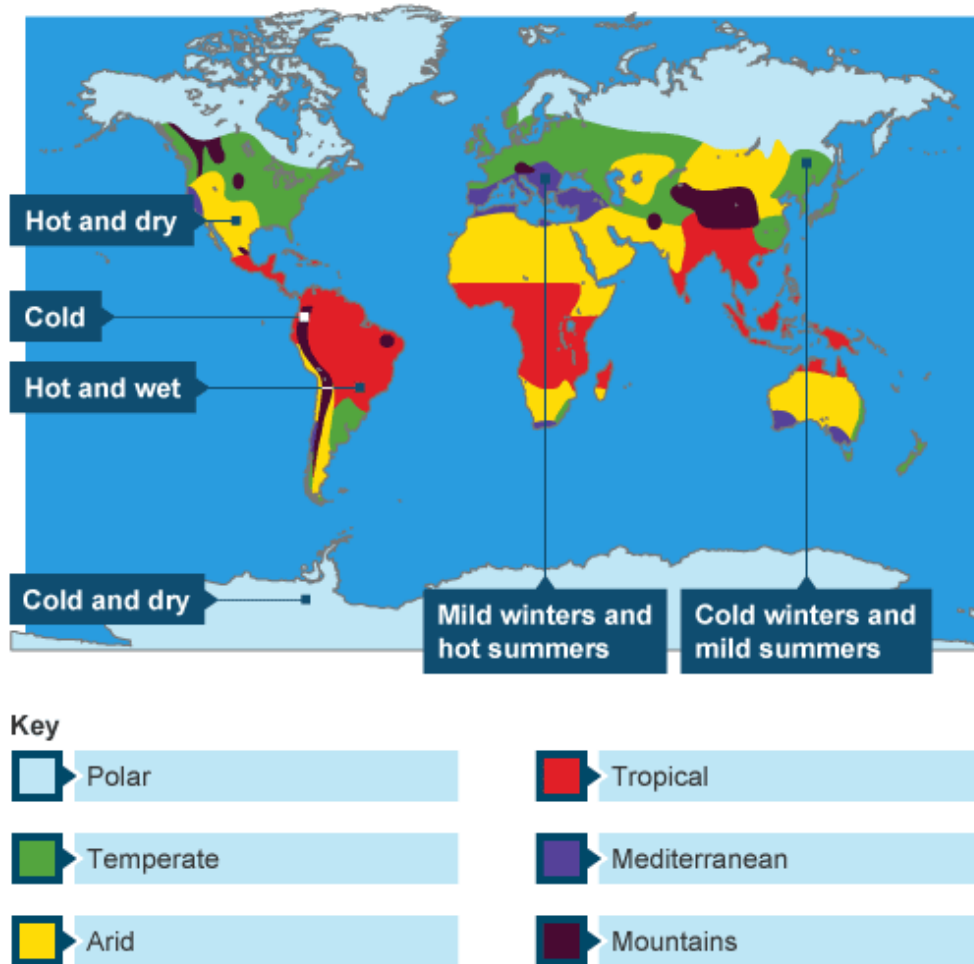
Climate is the long term weather patterns of a region, averaged over up to 30 years. Weather is the day-to-day changes in conditions of a specific area, and is much less predictable. Climate is what you expect, weather is what you get.

Q6. True or False?

The climate has changed before, so this change must be normal too

Scientists studying Antarctic ice cores have been able to determine the Antarctic temperature and CO2 trends over the last 800,000 years, and have shown that the climate has fluctuated greatly.
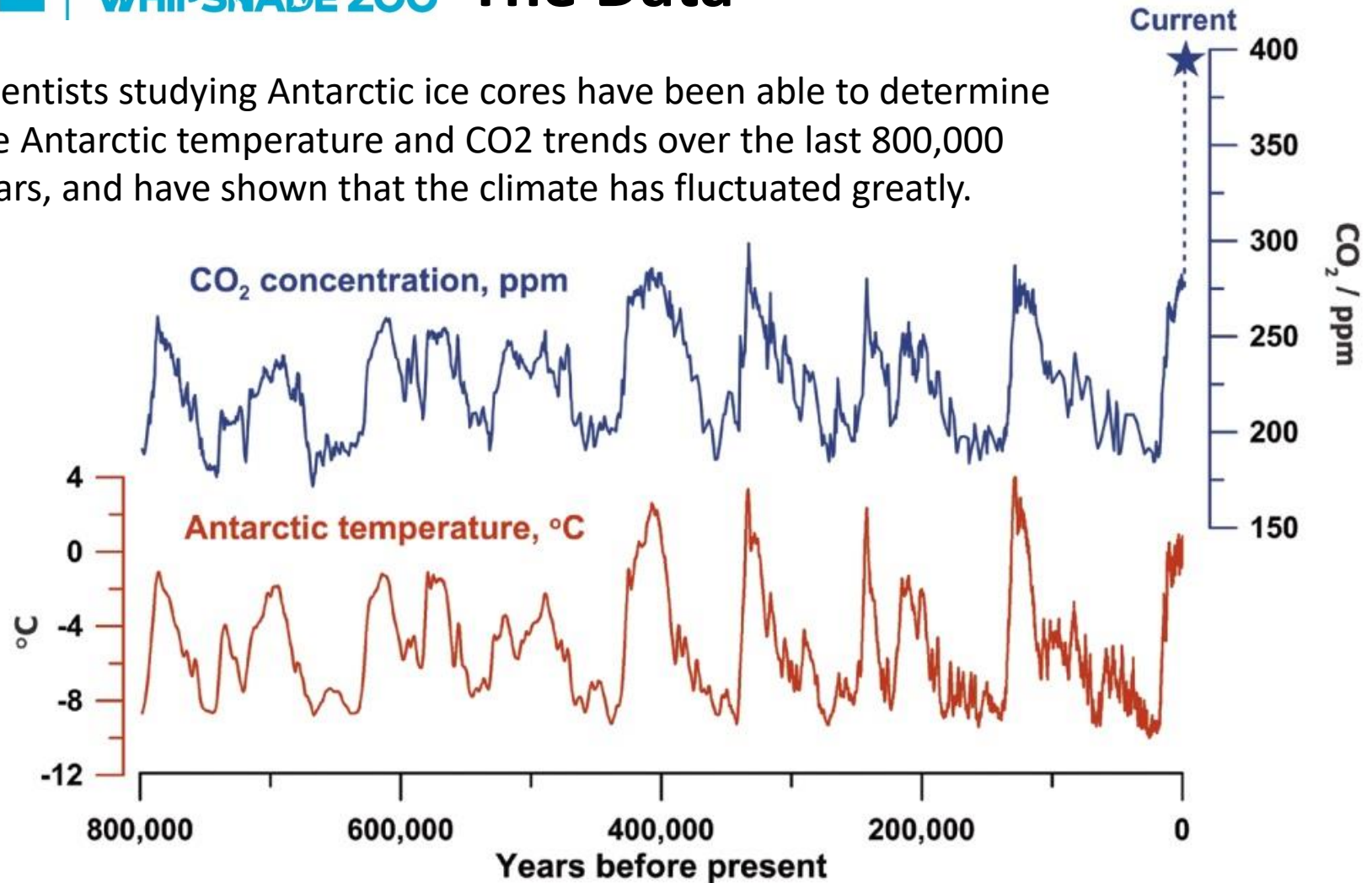
Source: Simple Climate, 2012. Credit to: Jeremy Shakun/Harvard University

Q7. What do you notice about the two lines? Do they match each other or are the completely different?

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The graph shows that the Earth's climate has always fluctuated, but what's happening now is different to what's happened in the past.
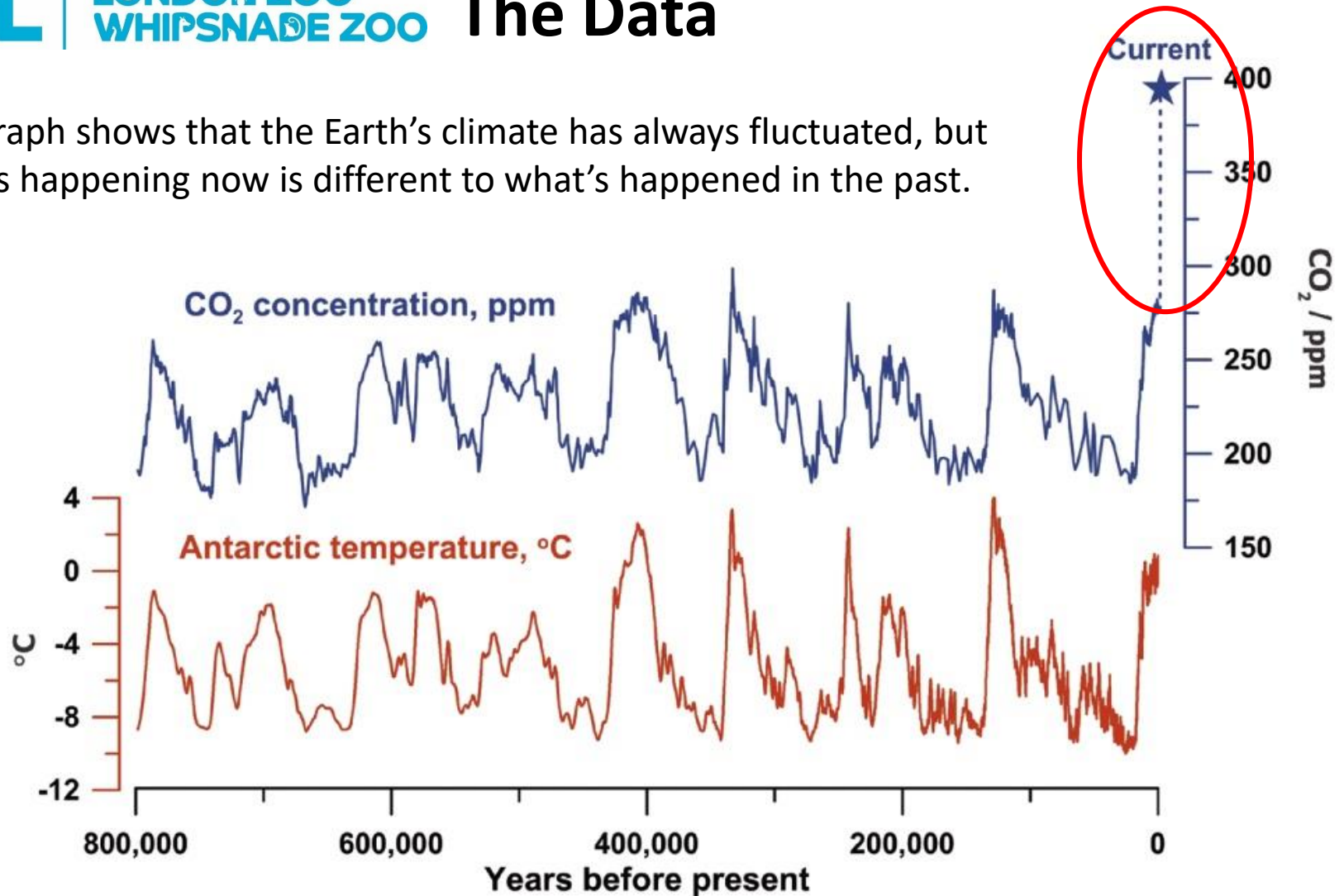
Source: Simple Climate, 2012. Credit to: Jeremy Shakun/Harvard University

Q8. What do you notice about the part of the graph inside the red circle, leading up to the present day?
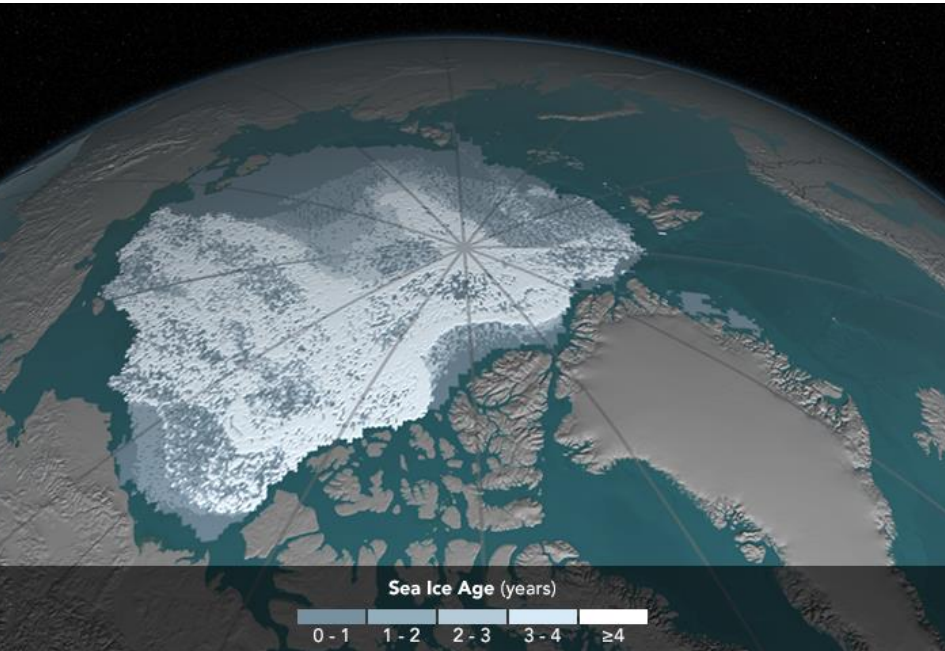
Impacts of climate change on <u>humans</u>

Q9. Using the below pictures as inspiration, can you think of six impact that climate change might have on people around the world?

Impacts of climate change

**Arctic Sea Ice
1984**

**Arctic Sea Ice
2016**
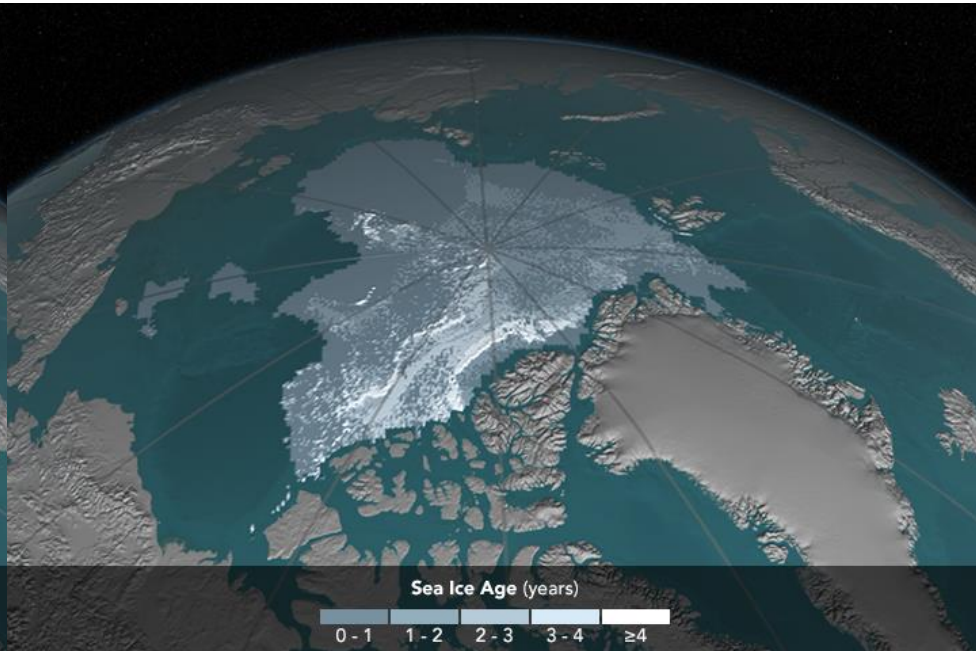
Source: Ed Hawkins [Of the National Centre for Atmospheric Science (NCAS)]

This image shows that not only is the amount of Arctic Sea Ice decreasing, but that the ice that is still there is thinner than previously.

Some scientists believe that at this rate the Arctic could be ice-free by 2030 or even earlier.

Q10. What will the impacts of this loss of sea ice be on people and animals?

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Impacts of climate change

Why do we get more floods and storms if the world is getting warmer?
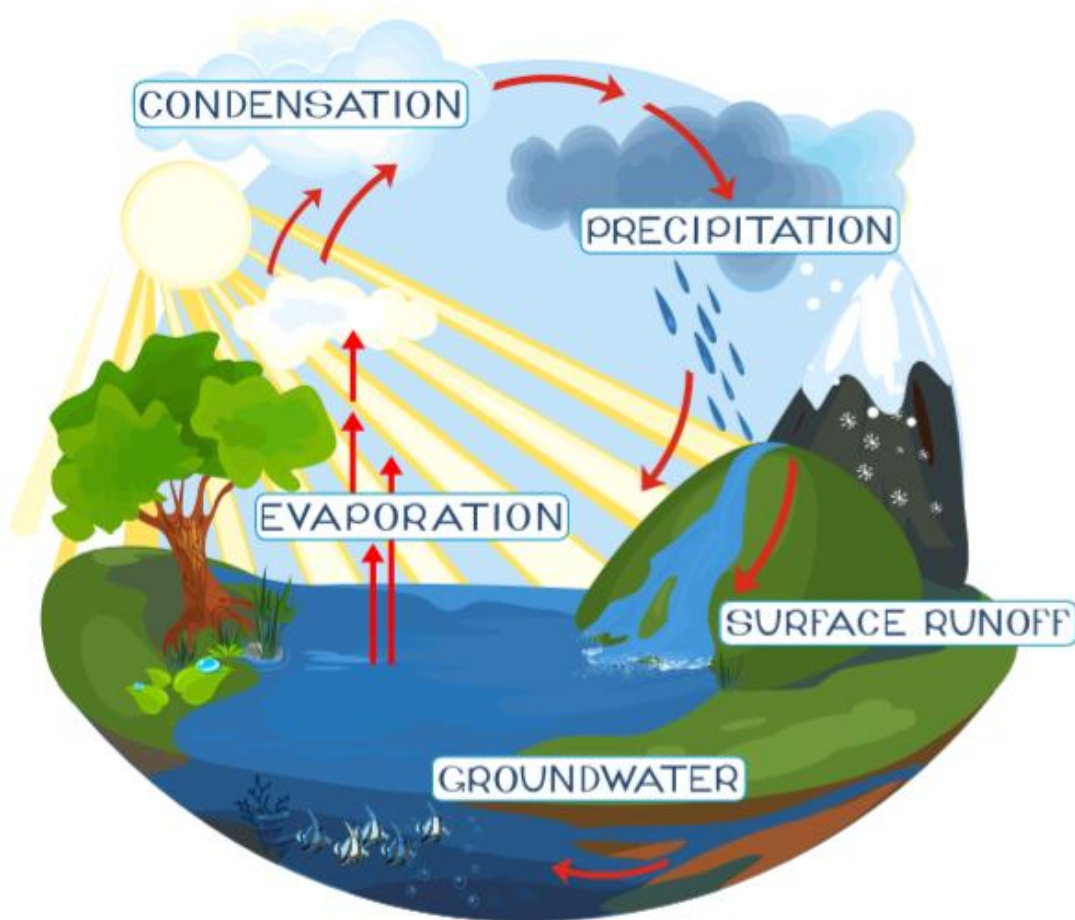
Understanding the water cycle can help to explain how global warming will lead to increasing floods and storms.

Q11. Recap the water cycle by writing down each stage, beginning with evaporation from the oceans.

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Impacts of climate change

Why do we get more floods and storms if the world is getting warmer?

Q12. For each of the below, explain how it will impact the water cycle and lead to more floods, storms and droughts.

2. Hot air can hold more water vapour than cold air.

3. The more intense the rainfall, the more the risk of flooding.

1. More evaporation happens at higher temperatures.

EVAPORATION

GROUND

4. Intense rainfall doesn't have time to soak into the ground before it runs off.

Impact of climate change on animals

ZSL has a numerous scientists in it's [Institute of Zoology](#) researching the impact that climate change is having on species all around the world.

The next few slides feature a number of these projects. Read the data and the see if you can answer the questions to determine how the changing planet is already impacting animals.

CORAL REEFS

RESEARCH QUESTION: How did the high temperature event from 2014-2017 affect corals in the Chagos Archipelago?

BACKGROUND INFORMATION:

- Coral reefs are home to more than one quarter of all marine life – a greater variety of life than even tropical rainforests.
- Coral has algae that lives inside it, providing it with food (and it's colour). When corals experience stress (like rising temperatures) they 'spit out' this algae, losing their food source and turning white (coral bleaching). If they remain stressed they won't take the algae back in and will starve.
- There are no people living on the islands in the Chagos Archipelago, so any impact on corals is mainly due to global environmental changes e.g. global warming.

METHODOLOGY: Coral cover was sampled by eye using quadrats(and in some locations video) before, during, and after the high temperature event.

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CORAL REEFS

RESULTS: Graph

Graph shows the percentage seabed covered by coral between 1978-2017, alongside the ocean temperature. Periods of warming are highlighted in red.
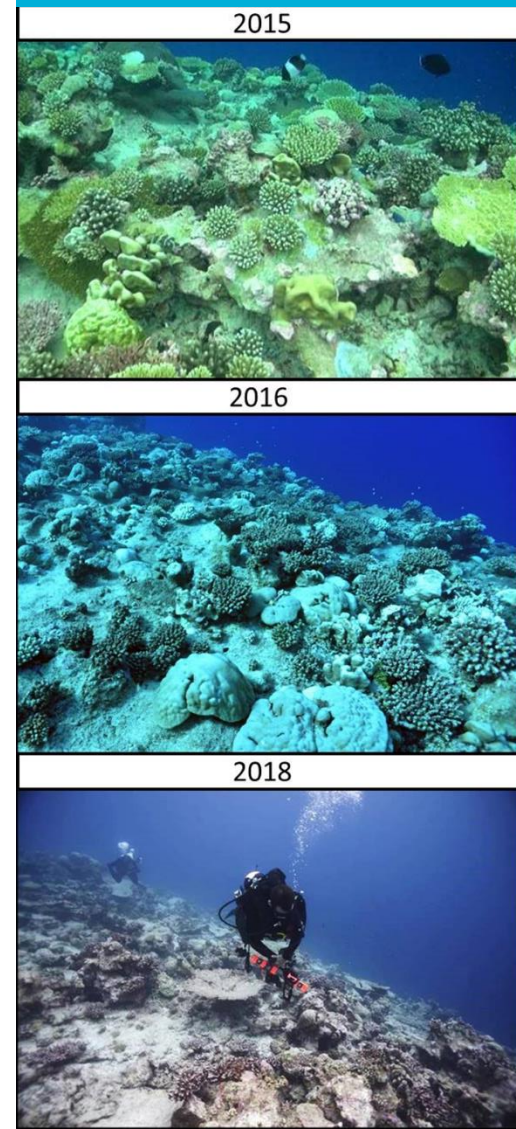
Ocean temperature over time

Temperature

Average

.995   2000   2005   2010   2015

Coral cover on ocean reefs, Chagos

- 5 m
- 10 m
- 15 m
- 20 m
- 25 m

Percentage coral cover

80
70
60
50
40
30
20
10
0

1995   2000   2015   2020

Study period

RESULTS: Photos

2015

2016

2018

CORAL REEFS

Q13. During the high temperature event between 2014-2017, what happened to coral cover in the Chagos Archipelago?

Q14. If corals become stressed more frequently by the high temperatures caused by climate change what might happen to them?

Q15. How will this effect the other animals in the ocean?

HUNTING DOGS

**RESEARCH QUESTION:** The present range of African hunting dogs is just 7% of its former distribution. Is climate change causing hunting dog populations to decrease?

BACKGROUND INFORMATION:

- African hunting dogs hunt by participating in long chases.
- They are crepuscular (active at dawn and dusk) for hunting and activity, due to cooler temperatures. They cannot hunt at night as it is too dark.
- They need to catch enough food to feed to their young and for females to produce enough milk, otherwise pups may not survive.

METHODOLOGY:

- Between 1989 and 2013 scientists studied 73 packs of African hunting dogs across Botswana, Kenya and Zimbabwe .
- Activity levels for the dogs and daily temperatures and rainfall for these areas were recorded.
- One dog within each pack was fitted with a radio-collar to allow scientists to track the pack and assess the number of cubs.

Ingo Arndt / naturepl.com

zsl.org
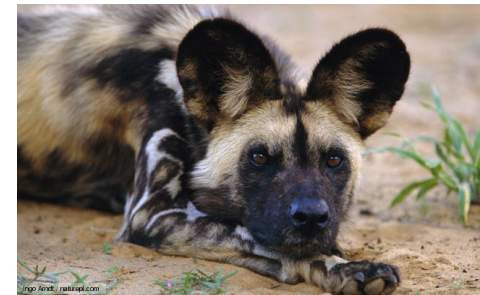
HUNTING DOGS

RESULTS:
Change in Temperature of study area over time.
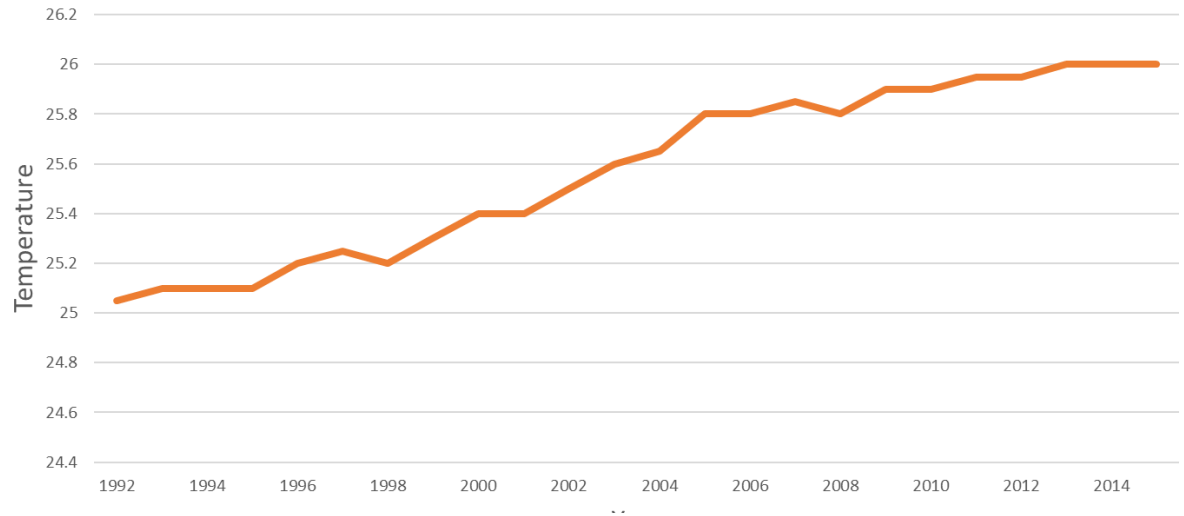
RESULTS:
Change in survival rate of hunting dog pups over time
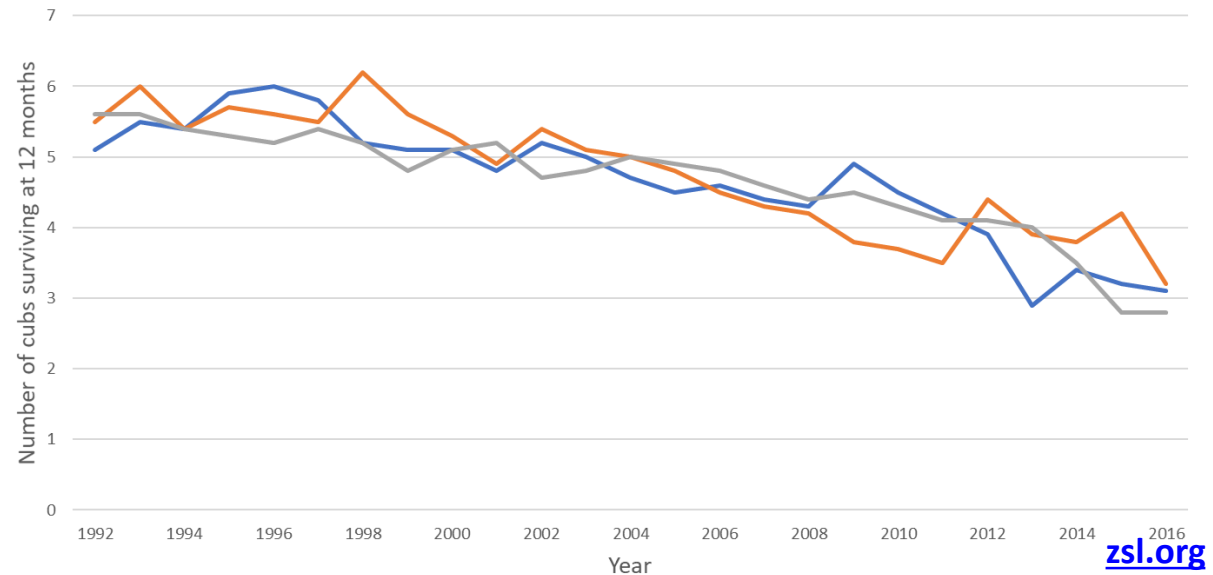
HUNTING DOGS

RESULTS: Hunting Dog Activity levels

Average activity level of dogs at **start** of study period (lower temperatures)

Average activity level of dogs at **end** of study period (higher temperatures)
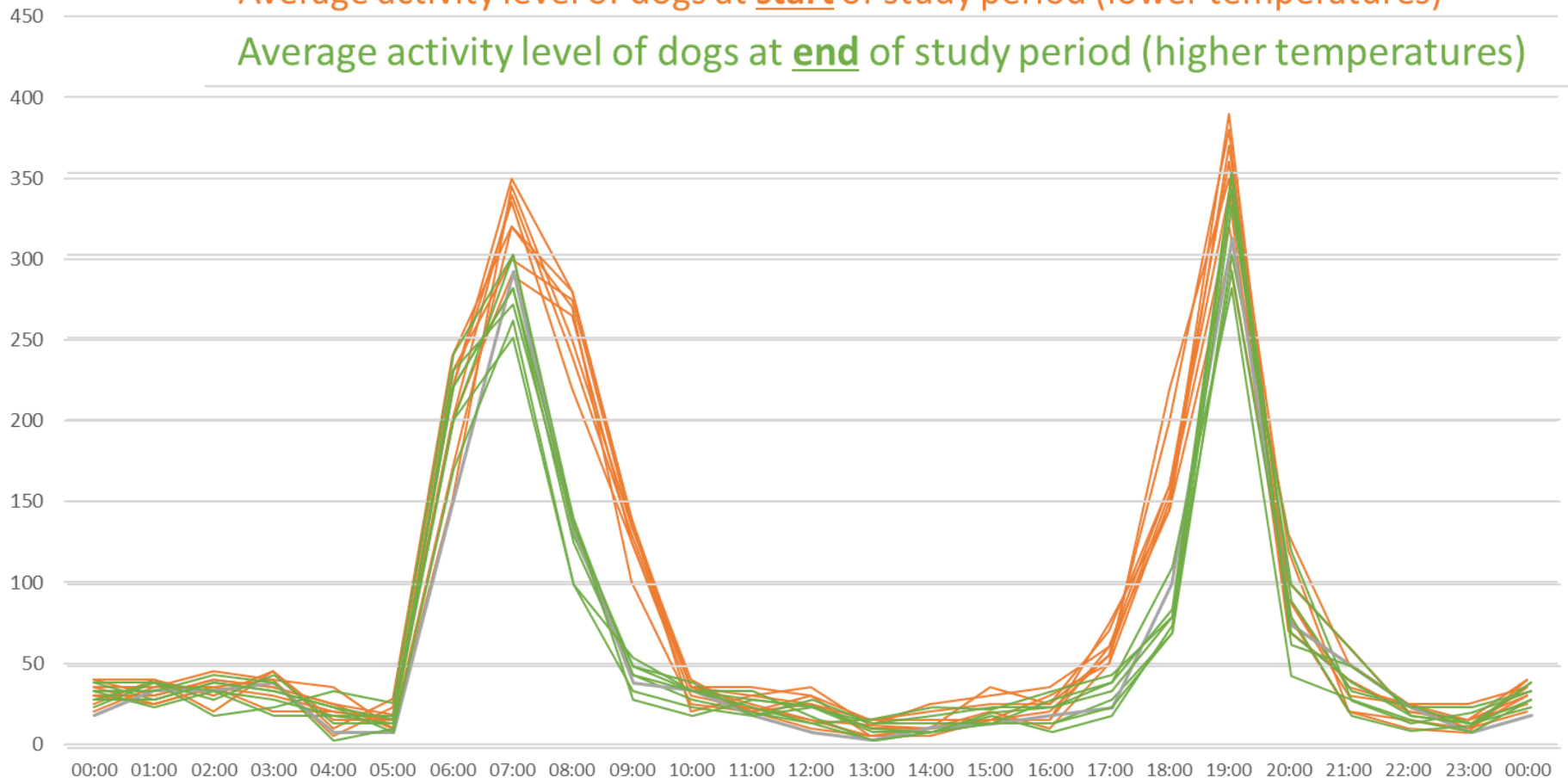
Q16. What happened to the temperature of the study area between 1992-2016?

Q17. What happened to the survival rate of the pups between 1992-2016?

Q18. Compare the activity levels of the dogs at the beginning and end of the study period. How did (a) the level of activity and (b) how long they were active for differ at the end of the study from the beginning.

Q19. Why might this have led to the change in survival rate of the pups?

Q20. What impact might climate change have on the survival of hunting dogs in the future?

What we can do

The average global temperature is already increasing, but the focus is now on limiting by how much this happens.

The Intergovernmental Panel for Climate Change has said that we need to halve global greenhouse gas emissions by 2030 if we want to limit warming to a safe 1.5°C increase.
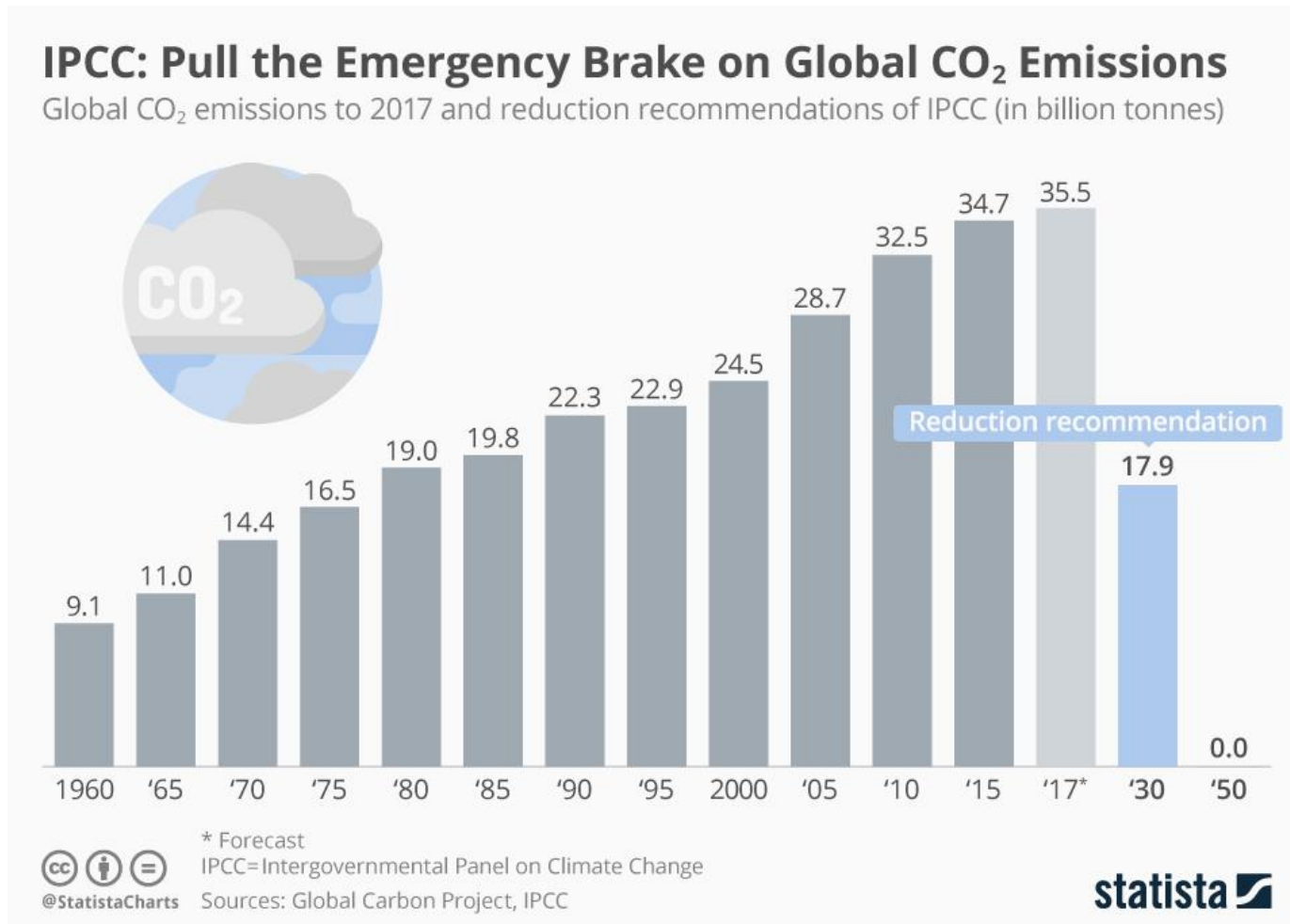
IPCC: Pull the Emergency Brake on Global CO_2 Emissions

Global CO_2 emissions to 2017 and reduction recommendations of IPCC (in billion tonnes)

Year	Value
1960	9.1
'65	11.0
'70	14.4
'75	16.5
'80	19.0
'85	19.8
'90	22.3
'95	22.9
2000	24.5
'05	28.7
'10	32.5
'15	34.7
'17*	35.5
'30	17.9 (Reduction recommendation)
'50	0.0

* Forecast
IPCC=Intergovernmental Panel on Climate Change
@StatistaCharts Sources: Global Carbon Project, IPCC

statista

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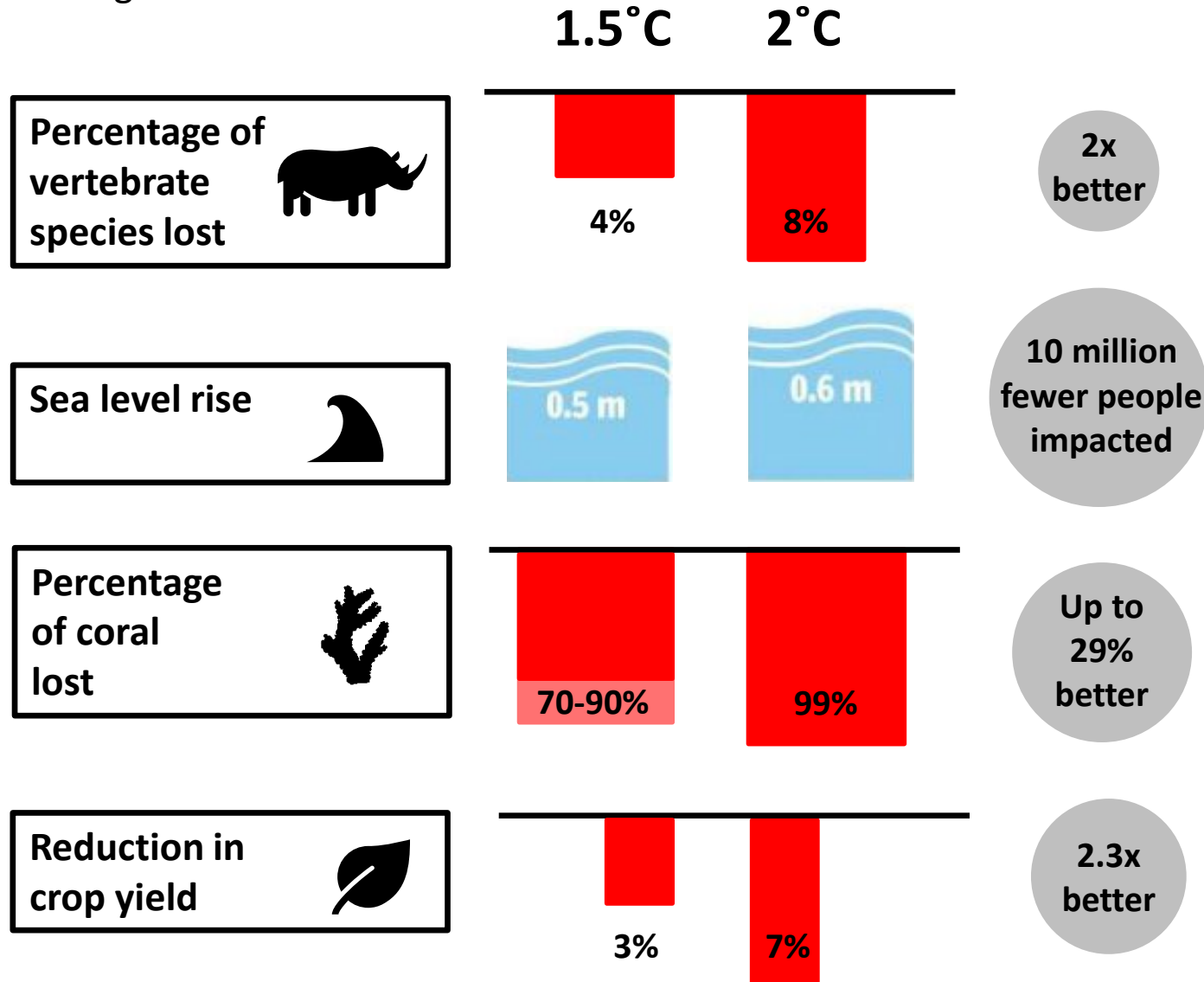
ZSL | **LONDON ZOO WHIPSNADE ZOO**

Each one of us can play a part in limiting warming to 1.5°C. You can think about this as reducing your **carbon footprint** – the amount of greenhouse gas emissions (often measured in CO2) that you're responsible for.

The best way to do this is to try and enact the 'Three Rs':

REDUCE

REUSE

RECYCLE

Q21. Rank the Three Rs in order of the most impactful to least impactful (though all three are important!)

Global Greenhouse Gas Emissions by Economic Sector

IPCC, 2014
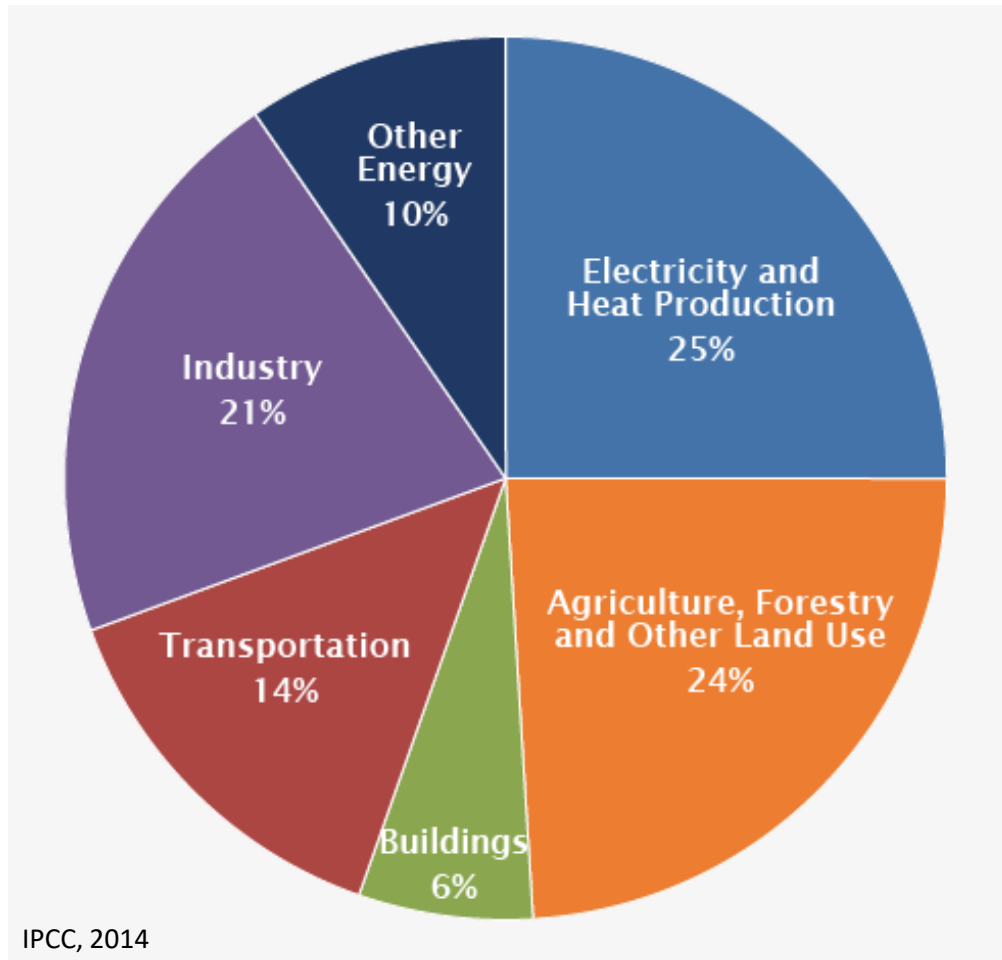
This chart shows the global proportions of greenhouse gas emissions made by each economic sector.

Q22. Keeping the 'Three Rs' in mind, can you think of something thing you can do to reduce your contribution to the greenhouse gas emissions of three of these areas?

What can you do?

Below are seven actions you could take to reduce your carbon footprint:

Avoid fast fashion
- 60% of fabric fibres are synthetic and derived from fossil fuels
- The industry is responsible for 10% of all man made emissions, more than flying and shipping combined.

Wait to upgrade your phone
- One study has said that by 2021 the carbon footprint of smartphones could exceed computers
- Less than 1 percent of smartphones get recycled.

Unplug phone chargers
- On average households in the UK have 40 electrical appliances
- A study in 2010 found that on average, our study households spent between £50 and £86 per year on standby appliances

Eat a plant based diet
- A 2018 survey reported that there are now 3.5million people in the UK identifying as vegan (7% of the population) – up from just 540,000 in 2016.
- Food accounts for 20% of all greenhouse gas emissions.

Wear a jumper instead of turning up the heating
- Over a quarter of the energy used in our homes is for heating.

Walk or bike instead of driving
- A survey in 2014 found that 23% of secondary school students travel to school in the car.
- On average secondary students live 3.4 miles away from school – a 51 minute walk or a 20 minute cycle

Hang dry your clothes instead of using the tumble dryer
- In the UK households run, on average, 5.5 washes a week.
- Households with a tumble dryer will dry 81% of their wash cycles using dryers

Q23. Put the above actions in order from most to least impactful, if you did them for a year.

What can you do?
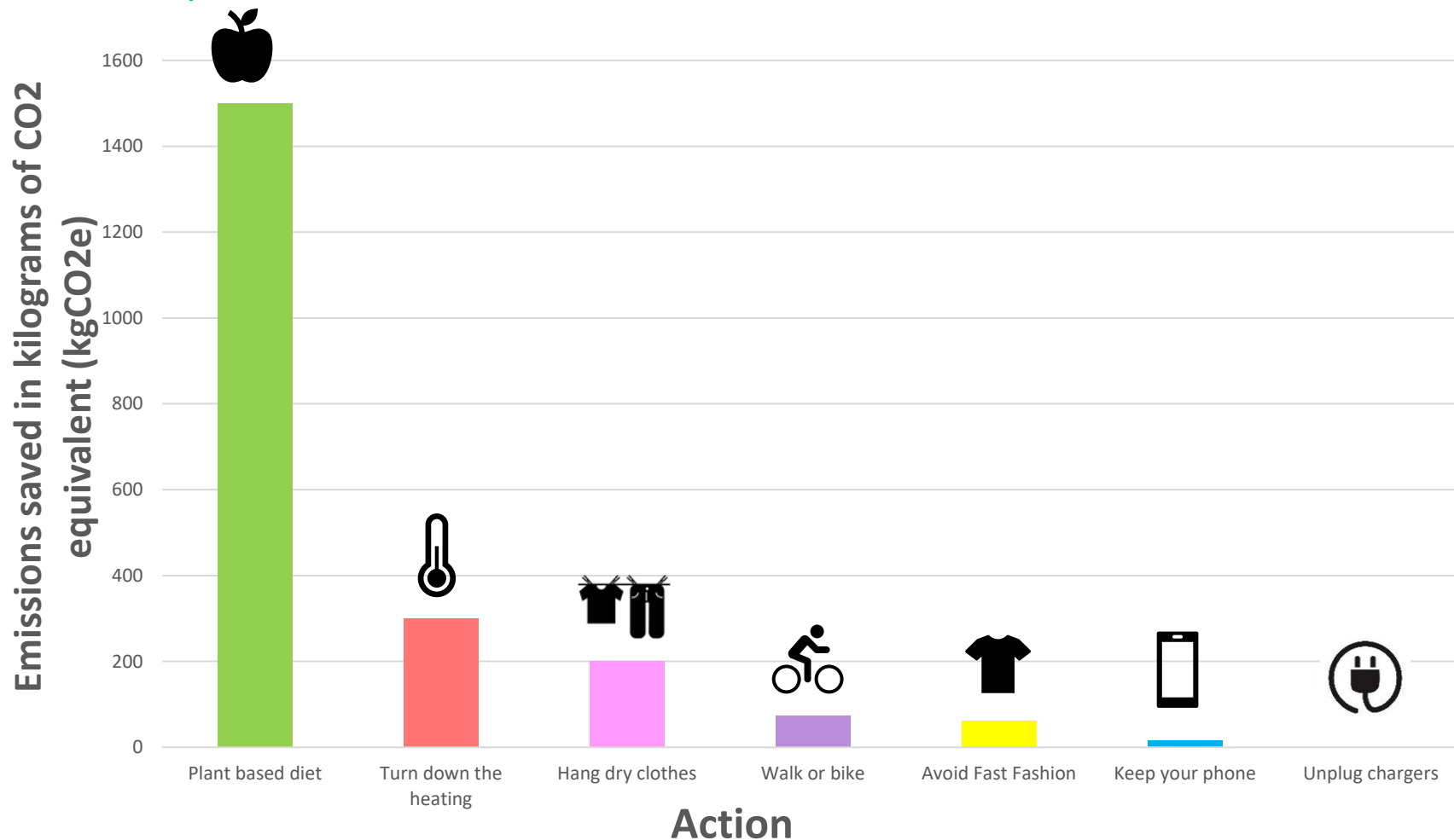
Converting to a plant based diet by far has the greatest impact – saving the equivalent of **1,500kg of CO_2 emissions per year.**

Even going meat free for one day a week saves **$373kgCO_2e$** over the year.

The next best action, turning down the heating 1 degree, saves **$300kgCO_2e$ of emissions across the year.**

Get Involved!

Q24. Pick one of the actions from the previous slide that you think you could do for the next month. Tweet us @ZSL_Learning to let us know which one you're trying out!

There's lots of ways other ways you could et involved too:

- Educate yourself

- Tell others

- Research and take part in group actions and campaigns

Thanks for joining!
If you want to find out more, check out the following :

ZSL research on climate change and African hunting dogs

Research in the Chagos Archipelago

Climate change and biodiversity

Follow us on Twitter:

@ZSL_Learning

zsl.org

Answers

Q1. Global warming is caused by there being greenhouse gases in the earth's atmosphere

False. We need greenhouse gases in the earth's atmosphere. The problem is that there are too much of these gases, enhancing the greenhouse effect.

Q2. Can you name three greenhouse gases?

Carbon dioxide, methane, water vapour, nitrous oxide, ozone.

Q3. Can you think of four sources of greenhouse gases?

- Burning fossil fuels for electricity – e.g. coal-fired power stations
- Transport emissions – not just from cars, but also planes etc.
- Cattle farming – cows produce methane as a by-product of their digestion
- Deforestation – less CO2 uptake if fewer trees to photosynthesis, plus trees are carbon stores.

Q4. True or false – climate change is the same as global warming?

False. Global warming is the increase in the average temperature of the planet, climate change is the changes to climate that this increase causes.

Q5. True or false – One day's weather can tell us if climate change is happening?

False. Climate is averaged over a long period, whereas weather fluctuates day to day within this.

Q7. What do you notice about the two lines? Do they match each other or are the completely different?

The lines mirror each other, with temperature lagging slightly behind as it responds to the increase in greenhouse gases.

Q8. What do you notice about the part of the graph inside the red circle, leading up to the present day?

The amount of CO2 in the atmosphere has increased to a level higher than at any time in the last 800,000 years. There's been almost a 50% increase in global CO_2 emissions since 1990. In **June 2018 average CO_2 concentration was 410.79 ppm.**

Q9. Can you think of six impacts that climate change might have on people around the world?

- More frequent natural disasters
- Floods
- Drought
- Melting polar sea ice
- Sea level rise
- Forest fires
- Ocean acidification

- Increase in extreme weather events
- Impact on food production (particularly crops)
- Increase in spread of disease due to migration of disease carrying insects (mosquitos)
- Decrease in fresh water supplies due to contamination

Q11. Recap the water cycle by writing down each stage, beginning with evaporation from the oceans.

1. Energy from the Sun heats water in the Earth's surface and it is evaporated from the ocean, rivers and lakes. The warm air rises, carrying water vapour with it.
2. The air cools as it rises, and the vapour condenses into liquid water in clouds.
3. As these droplets get bigger and heavier, they begin to fall as precipitation (snow, rain and sleet etc.)
4. Through surface run off and percolation, this water then returns to the ocean.

Q12. For each of the below, explain how it will impact the water cycle and lead to more floods, storms and droughts.

1. Higher temperatures mean there is more evaporation from the land and sea into the atmosphere, meaning more and heavier precipitation.
2. As the air gets warmer, it can hold more water vapour. This can lead to more intense rainstorms.
3. Intense rain increases the risk of flooding. Much of this water runs off into rivers and streams, doing little to dampen soil.
4. This run off, combined with increased temperatures, increases the risk of drought.

Q13. During the high temperature event between 2014-2017, what happened to coral cover in the Chagos Archipelago?

Coral cover decreased significantly, with corals at 10m being impacted the most. The coral cover decreased to similar levels as during the last high temperature event in the late 1990s.

Q14. If corals become stressed more frequently by the high temperatures caused by climate change what might happen to them?

When corals become stressed they expel the algae that lives inside them (which provides them with their food and their colour), becoming 'bleached'. If they are continually stressed, they won't let the algae back in and so will starve to death. If high temperature events increase in frequency, coral cover will continue to decline as the coral will die.

Q15. How will this effect the other animals in the ocean?

Though hey occupy less than 1% of the ocean floor, coral reefs are home to more than 25% of marine life. They are a vital part of this ecosystem, so if corals disappear, it will have a huge knock on effect on the health of ocean life.

Q16. What happened to the temperature of the study area between 1992-2016?

It increased from just over 25⁰C to 26⁰C.

Q17. What happened to the survival rate of the pups between 1992-2016?

The number of cubs surviving to 12 months nearly halved, from around 6 to around 3.

Q18. Compare the activity levels of the dogs at the beginning and end of the study period. How did (a) the level of activity and (b) how long they were active for differ at the end of the study from the beginning.

(a) The activity level of the hunting dogs was lower in both the morning and the evening at the end of the study, compared with the beginning.
(b) They were active for a shorter interval (both morning and evening) at the end of the study period.

Q19. Why might this have led to the change in survival rate of the pups?

Hunting dogs are active in the coolest parts of the day, morning and evening, hunting for their prey. As the temperature increased, their hunting activity decreased and they hunted for a shorter time. This may have meant they were less successful in their hunts, and couldn't hunt enough prey to enable the mothers to produce enough milk to feed their cubs.

Q20. What impact might climate change have on the survival of hunting dogs in the future?

If their habitat continues increasing in temperature, the number of pups they are able to rear may fall even further, until they are unable to rear any, and the species would go extinct.

Q21. Rank the Three Rs in order of the most impactful to least impactful (though all three are important!)

Reducing your use of items is the most impactful, as it means that new products don't need to be created, and no fossil fuels are burnt or greenhouse gases emitted in the process of their production. Reusing things is the next best option as this doesn't drive production. Recycling is the third, though recycling materials only generates a fraction of the greenhouse gases that the production of a new item does.

Q22. Keeping the 'Three Rs' in mind, can you think of one thing you can do to reduce your contribution to the greenhouse gas emissions of each of these areas?

Examples:
- Industry – recycle old electricals, recycle packaging, use clothes until they wear out
- Transportation – use public transport, walk more, cycle more
- Agriculture – eat less red meat, meat free Mondays, go plant based
- Electricity and heat production – don't turn up the heating, keep doors closed

Q23. Put the above actions in order from most to least impactful, if you did them for a year.

1. Convert to a plant based diet. On average, a meat eating diet produces **1,500kgCO$_2$e** more per year than a vegan diet (more than double), and **1,200kgCO$_2$e** more than a vegetarian diet. Going meat free for one day a week would save **373kgCO$_2$e** per year.

2. Reducing your heating by 1˚C across one whole year would save **300kgCO$_2$e** of emissions

3. Hang drying your clothes instead of using the tumble dryer for a year could save up to **200kgCO$_2$e of emissions.**

4. Walking instead of driving for one mile a day will save **74kgCO$_2$e** across an entire year.

5. Buy one fewer outfit per year - one outfit can have a carbon footprint of **62kgCO$_2$e** – more than the equivalent of driving from London to Paris.

6. Keep your phone for an extra year. On average a smartphone produces **16kgCO$_2$e** during its production. Texting is a much lower-carbon option than calling as it requires less infrastructure (e.g. servers running 24/7 and air con etc)

7. Unplug all your chargers. Leaving one phone charger plugged in all year round even when not in use uses **0.6kgCO$_2$e**. The biggest phantom power consumers include any device with a remote control, a charger, or a continuous display, but even appliances that look like their off may be drawing power.