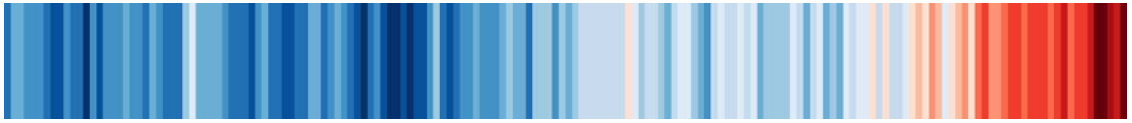


Climate Science Market Place

Rules:

- Work in pairs/threes on one topic (climate change, 2^{o}C warming, 1.5^{o}C warming, tipping points).
- Each topic has 4 subtopics and information cards to map around the centred topic card.
- Finish each topic by discussing, in your pair/three, the big question on the topic card.
- Jumble up your topic cards and move on to another topic.

Climate Change Is it everybody's problem?	Politicians	The world has the means to keep warming below 1.5°C, if politicians agree	Changes in weather and seasons have an impact on vegetation – wild and crops	More intense Tropical Cyclones (hurricanes)	As CO_2 rises, oceans warm and become more acidic, leading to coral reef death
Respond to climate protests and lobbying from individuals and organisations	The world has already warmed by more than 1°C above pre-industrial levels	A glacier lying in one country may be the main water supply for another country	Migrating fish stocks create tension between fisheries in different countries	Climate refugees cause territorial issues	Climate affects agriculture, tourism and business
National pledges have an impact on individuals and businesses	Floods and winds can overwhelm transport networks and power supply	War	Conflicts undermine lives, encourage migration and weaken culture	In a warmer climate, extremely warm weather is expected more often, and extremely cold weather less often	Drought causes crop failure which can lead to starvation
Loss of ice leads to ocean absorbing more sunlight – increases polar melt (positive feedback)	1/6 of people globally rely on glaciers for drinking water and water for agriculture	Rising atmospheric and oceanic temperatures cause polar melting	Although 1.5°C may seem small, the changes in extreme weather will have a far greater impact on people's lives	Subtropical dry (desert) zones get larger	Global climate

Although 1.5°C may seem small, the climate will vary a lot more for some people than for others	Coastal areas vulnerable to sea level rise and increased storminess	Extreme Weather	People and ecosystems are affected by climate in different ways and magnitudes	More intense extreme rainfall events	**2°C warming** Is 2°C a safe level of warming?
13% of land area where ecosystems will change significantly	9% reduction in maize yield by 2100	30% less water available in warm climates such as Mediterranean	Emissions Target	Oceans and ice	Ecosystems
99% of coral reefs will be gone by 2100	37% global population exposed to severe heat at least once every five years	No scientists have justified or defended the 2°C target as a safe level of warming	Ocean acidity will increase by 29% by 2050	Mediterranean reduction in surface water run-off is 17%	89mm global glacier mass loss during 21st century
2°C target set after the 2009 Climate Conference in Copenhagen	72 million people flooded globally each year in coastal areas by 2095	Decline by 20% by 2030 and hit net zero emissions by 2075	Sea level rise of 50cm by 2100 and 2-3m by 2300	Probability of a sea-ice free Arctic summer is once a decade	18% of insects, 16% of plants and 8% of vertebrates will lose half their geographic range

3 million tonnes decline in marine fisheries	Extreme weather	2.6°C increase in annual maximum daily temperature	3 months heatwave duration in tropical regions	36% increase of frequency of rainfall extremes over land	Target is easy to communicate
The world is currently on track to blow through this carbon budget by 2049	**1.5°C warming** Is 1.5°C a safe level of warming?	Extreme weather	1.7°C increase in annual maximum daily temperature	Oceans and ice	Probability of a sea-ice free Arctic summer is once a century
Ocean acidity will increase by 17% by 2050	Sea level rise of 40cm by 2100 and 1.5m by 2300	14% global population exposed to severe heat at least once every five years	7% of land area where ecosystems will shift to a new biome	70% of coral reefs will be gone by 2100	Emissions Targets
Ecosystems	17% increase in frequency of extreme rainfall over land	76mm global glacier mass loss during 21st century	6% reduction in maize yield by 2100	Decline by 45% between 2010-2030 (can emit 750 $GtCO_2$) and hit net zero in 2050	6% of insects, 8% of plants and 4% of vertebrates will lose half their geographic range

The world is on track to blow through this carbon budget by 2030	The need to peak global emissions before 2030	If exceeded, carbon removal (from atmosphere and store it) could be used to meet the target	60 million people flooded globally each year in coastal areas by 2095	Technology such as carbon capture and storage can remove greenhouse gases from the atmosphere	Mediterranean reduction in run-off is 9%
1.5 million tonnes decline in marine fisheries	2 months heatwave duration in tropical regions	<u>Tipping points</u> Is gradual or abrupt climate change more concerning??	Arctic sea-ice abruptly changes from year-round ice cover, to seasonal ice cover	Boreal Forests shift north into the Arctic tundra	Extreme weather
Paleoclimate records show that when the climate was <2°C warmer, sea levels were 6-9m above present	Thawing frozen soils in the Arctic abruptly release additional greenhouse gases (CO_2 and methane)	Dying rainforest reduces rainfall	Deforestation and climate change lead to Amazon rainforest dieback. Vegetation shifts towards savannah.	Losses to fisheries and tourism	Spread of disease-bearing insects (e.g. mosquitoes and malaria)
Oceans	Ice	Coral reef die-off from rising temperatures and increasing ocean acidity	Ecosystems	Melting sea-ice causes the circulation of the Atlantic Ocean (AMOC) to slow down	AMOC slowdown leads to ecosystem changes in the oceans

West Antarctic ice sheet collapse eventually leads to 3m sea level rise

A positive is that this area will be open for shipping e.g. Russian Arctic ports

Arctic Ocean to be nearly ice-free in September (end of summer) before 2050, impacting the climate of all the Earth

Greenland ice sheet disintegrates due to rising temperatures: leads to 7m sea level rise

Changes in the Indian monsoon lead to extreme rainfall and impacts on agriculture

Abrupt changes to the west African monsoon impacts on agriculture and ecosystems

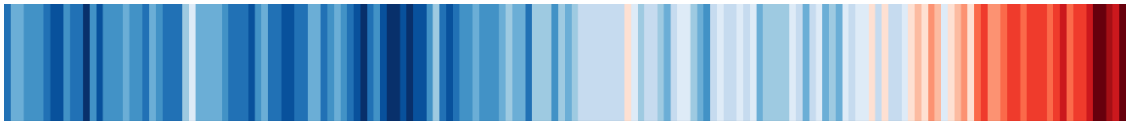
Dying rainforest releases carbon back into the atmosphere and increases the Greenhouse Effect

Thawing frozen soils allow more vegetation to grow in the Arctic. Growing vegetation removes carbon dioxide from the atmosphere.

Wildfires more common in a warmer Arctic, damaging vegetation and soils

Arctic vegetation reflects less of the Sun's light than frozen soil: the ground warms

Drought and fire danger in the eastern Amazon



Adaptation/Mitigation Market Place
Rules:

- Each delegate picks up a climate change adaptation/mitigation card and finds a partner.
- Each delegate reads out their card. Discuss whether each card represents an adaptation to and/or mitigation (prevention) of climate change. Does the card you have, or your partner's card, better suit the needs of your country? Negotiate whether to keep your own card or swap cards.
- Find a new partner.
- The game continues until each delegate has an adaptation/mitigation card that suits their country.
- If you still have time, discuss other ways to mitigate or adapt to climate change.
- Take back any ideas for adaptation or mitigation strategies that would work in your country and share them with your fellow country delegates!

Flood defences

To prevent or control the negative effects of flood waters with sea level rise and storm surges from increased extreme weather. Wetter winters and more intense rainfall will increase river flows and cause more surface run-off. Existing river and coastal flood defences will not be able to cope. New defences can include barriers, improving the flow in rivers and expanding beaches and floodplains.

Cost:	High
Climate:	Temperate/Tropical
Difficulty:	Low
Topography:	Any

Improve local firefighting capacity

Wild forest and bush fires are an increasing threat with climate change due to extreme weather such as increased length and intensity of summer droughts. Combatting this threat is important to save lives, arable land and productive forests. New developments should assess their fire risks and local firefighting organisations should be better resourced.

Cost:	Middle
Climate:	Dry
Difficulty:	Low
Topography:	Any

Carbon capture and storage

A technology that can capture up to 90% of the carbon dioxide emissions produced from the use of fossil fuels in electricity generation and industrial processes, preventing the carbon dioxide from entering the atmosphere. Stored underground in depleted oil and gas fields or deep saline aquifer formations. To ensure manufacturing industries can continue to operate without the associated emissions.

Cost:	High
Climate:	Any
Difficulty:	High
Topography:	Any

Migration agreements

Climate refugees from very low-lying islands which will be the guaranteed first populations heavily impacted by sea level rise, as it's too late to reverse these impacts. These populations need agreements to migrate to other higher elevation countries. However, migrants face problems to do with land ownership and their cultural identity.

Cost:	Low
Climate:	Tropical/Coastal
Difficulty:	High
Topography:	Flat

Solar energy

Helps meet energy needs and limits fossil fuel consumption and Greenhouse Gas emissions. High solar energy potential comes from high sunshine hours and available barren land in these sunny regions. New solar projects are undercutting costs of existing coal-fired plants.

Cost:	Middle
Climate:	Arid/Hot
Difficulty:	Middle
Topography:	Flat

Urban planning

New developments in large cities can be planned to reduce greenhouse gas emissions, reduce social inequality, improve the urban environment and reduce the impact of extreme heat. Measures include housing designed to need less air conditioning, tree planting, urban parks and lakes.

Cost:	High
Climate:	Any
Difficulty:	High
Topography:	Any

Tree planting

Tree planting and returning farm and grazing land to forest or grassland. To reduce desertification caused by overgrazing, overuse of water, and deforestation. This reduces Greenhouse Gas emissions and helps the country adapt to a changing climate.

Cost:	Low
Climate:	Temperate/Tropical
Difficulty:	Low
Topography:	Any

Improve water availability

To increase water availability as a result of shortages caused by drought or the melting of glaciers. Reliable water supplies are important for low income countries and for crop production. Reservoirs and high-tech micro-irrigation protect the water supply and make crop watering more efficient.

Cost:	Low
Climate:	Dry/Polar
Difficulty:	Middle
Topography:	Any

Fuel efficiency and public transport

To reduce GHG emissions by vehicles, which are a major contributor to climate change. Introduction of low-carbon fuel vehicles. Investment in public transport infrastructure and new low fossil fuel technologies is required.

Cost:	High
Climate:	Any
Difficulty:	High
Topography:	Any

Wind power

Helps meet a country's energy needs and limits fossil fuel consumption and Greenhouse Gas emissions. High wind power potential comes from large areas of sea territory with strong reliable wind and shallow water (offshore wind farms), and from coastal areas, at the top of rounded hills, open plains and gaps in mountains (onshore wind). New wind projects are now the cheapest source of energy.

Cost:	Low
Climate:	Coastal/Temperate
Difficulty:	Middle
Topography:	Flat plains and mountains

Economics Market Place

Climate finance and justice

Climate Justice looks at the ethics of climate change, examining issues like Equality, Human Rights, and Collective Rights. Which countries have, in the past, been **responsible** for the greenhouse gas emissions and land use changes which have contributed to the climate change we see today?

What is the fair way for us, as a global community, to prevent climate change in the future and help countries deal with the consequences which are already inevitable?

Those who are least responsible for climate change often suffer its most serious consequences.

Who should pay for countries to adapt to climate change, or to make changes that reduce their greenhouse gas emissions?

Instructions

1. Find a partner within the market place.
2. Should you or should your partner pay money into the Green Climate Fund? If both say yes, who should pay more? Remember to represent the interests of your country as well as what you, as an individual, think is fair.

   [You may like to refer back to your country facts at this stage]
3. Should you or should your partner receive money for losses & damages incurred through climate change and to help you reduce your future greenhouse gas emissions?
4. Now find a new partner.