



EN-US

Adults

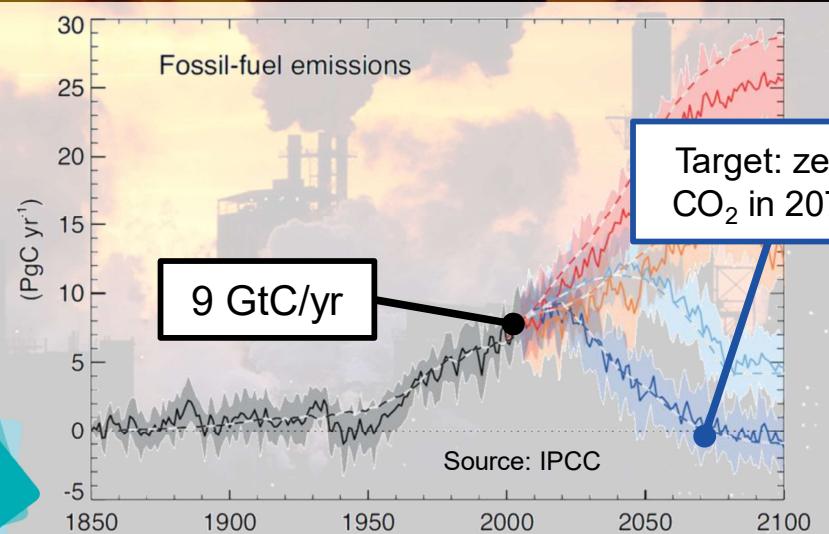
The Climate Fresk - EN-US - Adults - V7.3.1- 06/07/2021



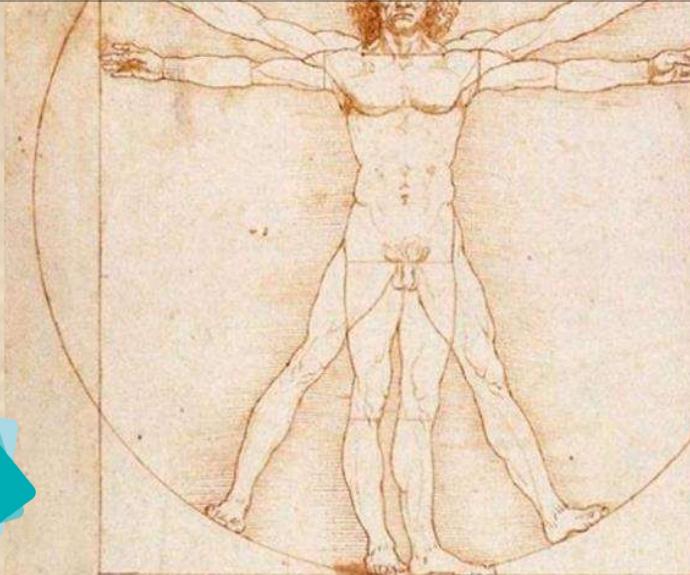
CLIMATE FRESK

All the cards are in your hands!

Fossil Fuels

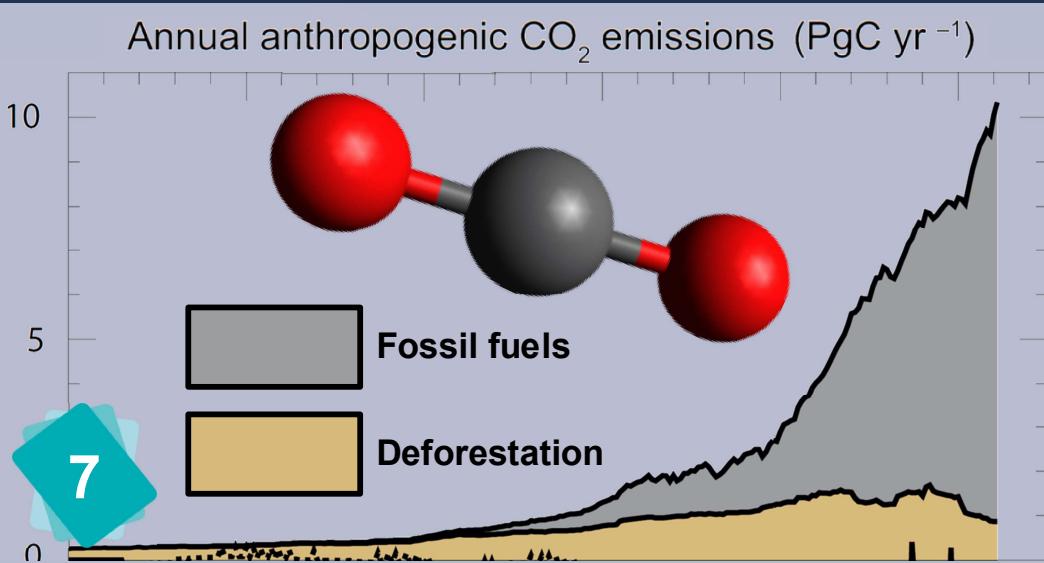


Human activities



1

CO₂ Emissions



5

Fossil fuels are coal, petroleum and natural gas. They are used mainly for transportation, industry and the usage of buildings. They emit CO₂ when burned.

Set 1

How to play

You need one deck of cards per team of 6 to 8 ppl, 36" x 80" paper roll or paper tablecloth, pencils, erasers, color felt tip pens and some tape.

The aim is for each team to place the cards on the table, find the cause-and-effect relationships between them and draw arrows between the cards to illustrate what climate change is about.

Deal the cards set by set and wait until all cards are down on the table before dealing the next set.

Time indications: one hour to place the cards, one hour to decorate the Fresk and one hour to sit down together and discuss what we have learned.



Reflective



Creativity



Review



Debrief

For a simpler (or quicker) version of the game, take out cards #10, #14, #15 and/or #41, #42.

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7

CO₂, or carbon dioxide, is the #1 human-made greenhouse gas in terms of emissions.

CO₂ emissions come from our use of fossil fuels and from deforestation.

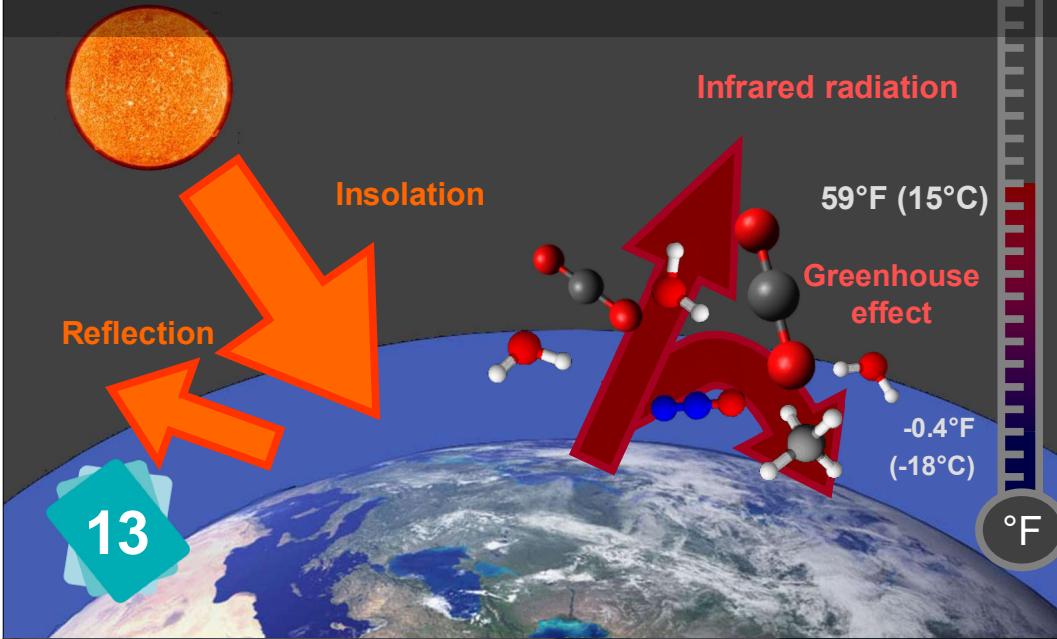
Set 1

1

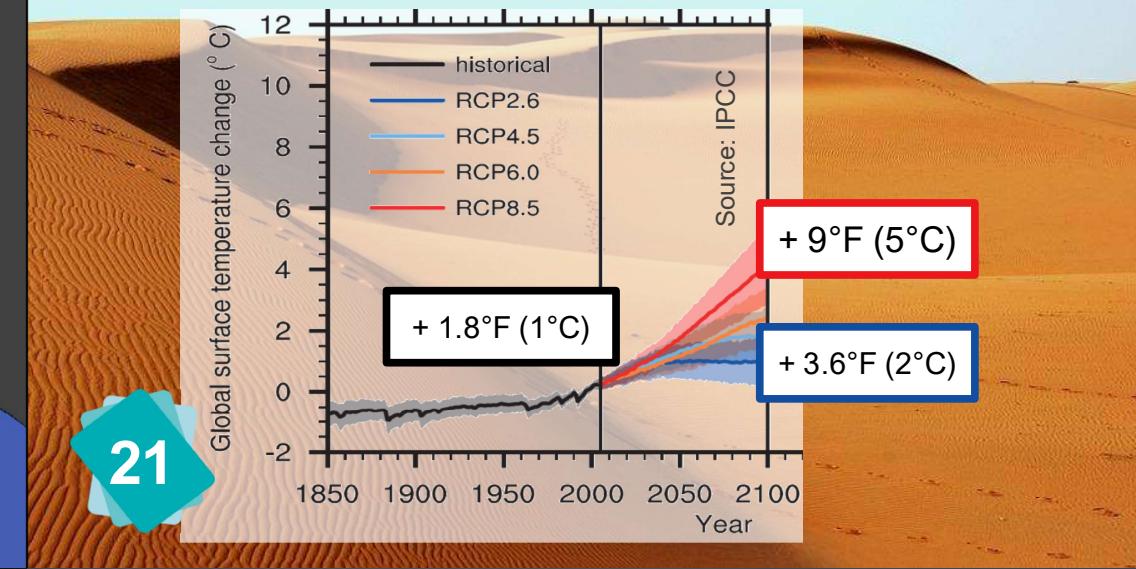
This is where it all begins.

Set 1

Additional Greenhouse Effect



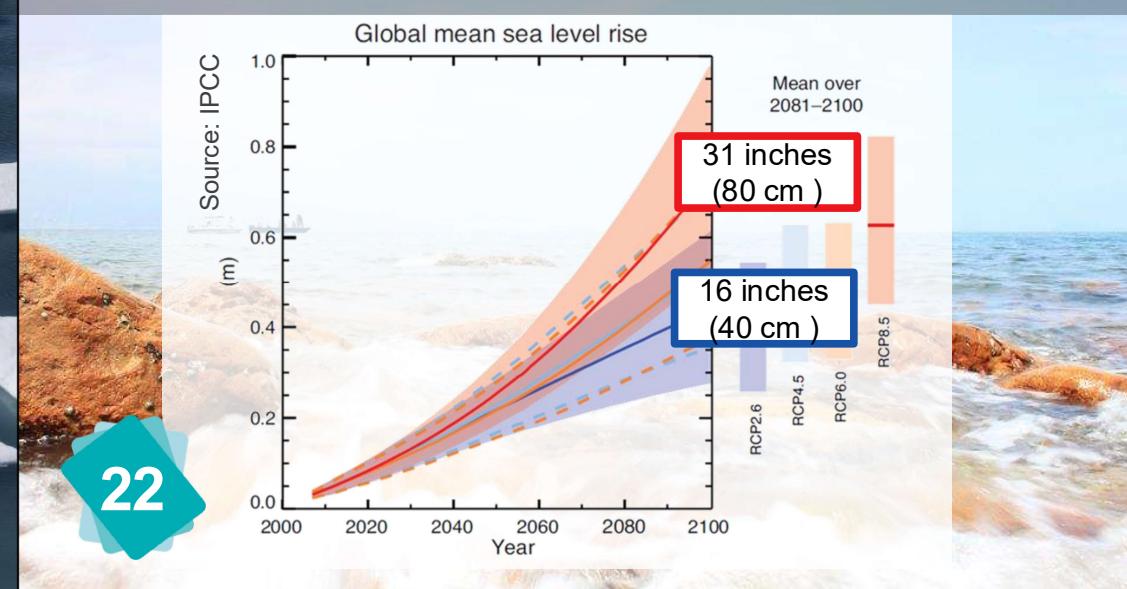
Temperature Rise



Melting of Sea Ice



Sea Level Rise



18

Sea ice melting does not make the sea level rise (just as a melting ice cube does not make a glass overflow).

However, when it melts, it gives way to the much darker sea, which goes on to absorb more sun rays than white ice.

Set 1

13

The greenhouse effect is a natural phenomenon - and incidentally, the first of the GHGs is water vapor. Without greenhouse effect, the planet would be 59°F (33°C) colder and life as we know it would not be possible.

But CO₂ and other GHGs related to human activity increase the natural greenhouse effect and unbalance the climate.

Set 1

22

Since 1900, sea level has risen by 7.9" (20 cm). Sea level rise is caused by the thermal expansion of ocean waters, and the melting of glaciers and continental glaciers.

Set 1

21

Here we are referring to the average air temperature above ground.

It has increased by 1.8°F (1°C) since 1900. Depending on the scenarios, the rise in temperature could reach 3.6°F (2°C) to 9°F (5°C) by 2100.

At the end of the last ice age, the average temperature was only 9°F (5°C) lower than today... and deglaciation took 10,000 years!

Set 1

Industry



2

Building Usage



3

Transportation



4

Deforestation



6

4



The transportation sector is highly dependent on petroleum.

It accounts for 15% of greenhouse gas emissions.

Set 2

6

Deforestation consists in cutting or burning down trees beyond the forest's natural ability to regrow. 80% of deforestation is driven by the expansion of agriculture.

Set 2

2



Industry uses fossil fuels and electricity. It accounts for 40% of greenhouse gas emissions.

Set 2

3

Buildings (housing and commercial use) use fossil fuels and electricity. They account for 20% of greenhouse gas emissions.

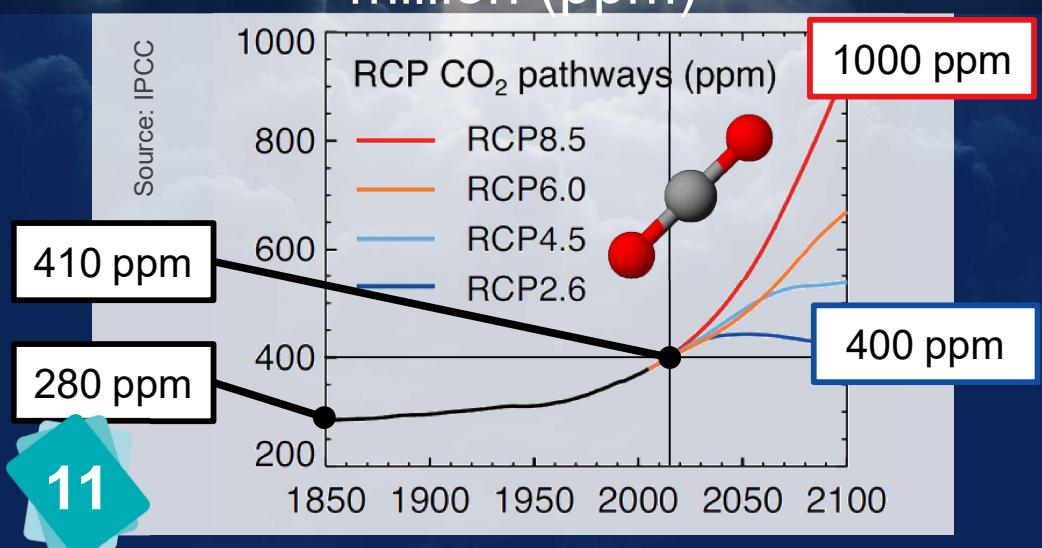
Set 2



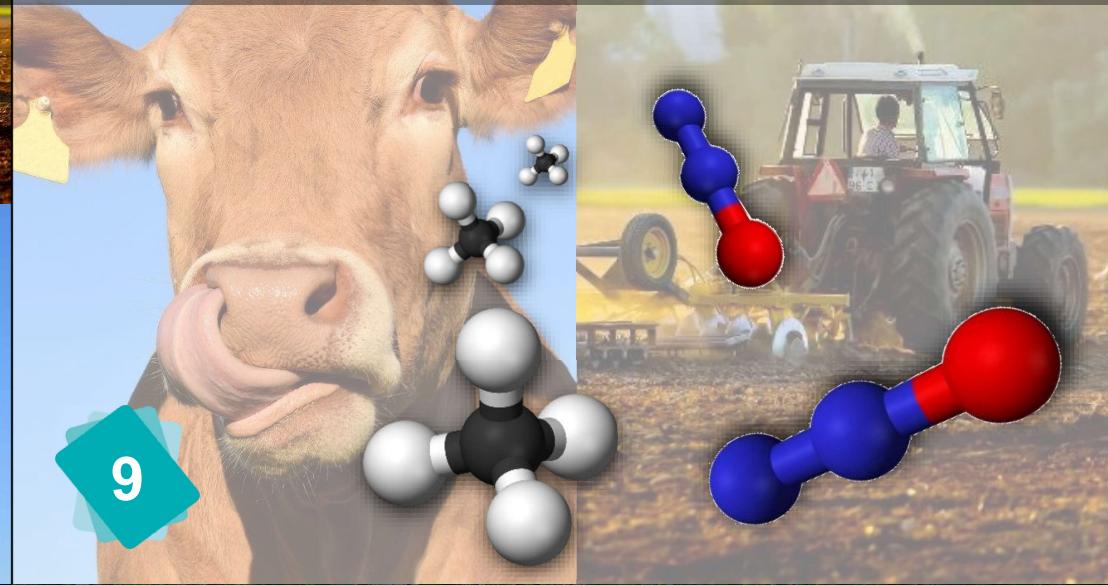
Agriculture



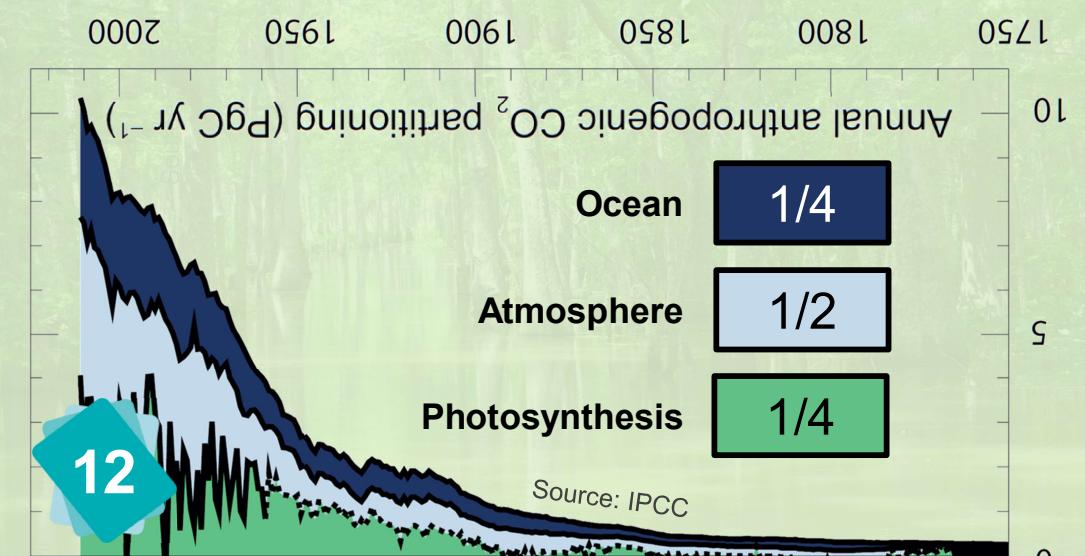
Concentration of CO₂ in parts per million (ppm)



Other GHGs



Carbon Sinks



11

About half of our CO₂ emissions are captured by natural carbon sinks. The other half stays in the atmosphere.

Concentrations of CO₂ in the air have increased from 280 to 410 ppm (parts per million) over the past 150 years.

Set 2

12

Half of the CO₂ we emit every year is absorbed by carbon sinks:

- 1/4 by vegetation (through photosynthesis)
- 1/4 by the ocean

The remaining half stays in the atmosphere.

Set 2

8

Agriculture does not emit a lot of CO₂, but is responsible for the emission of large quantities of methane (from cows and rice paddies) and of nitrous oxide (from fertilizers).

In all, agriculture amounts for 25% of GHGs if we include induced deforestation.

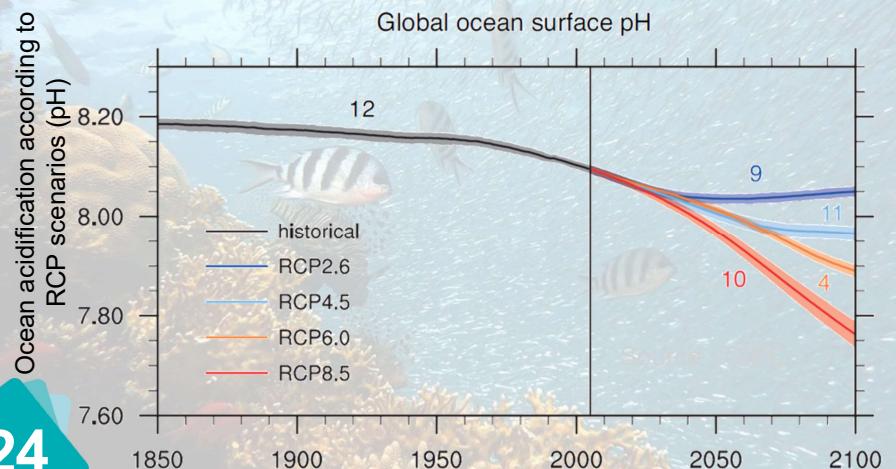
Set 2

9

CO₂ is not the only greenhouse gas (GHG). Among others are methane (CH₄), and nitrous oxide (N₂O), two gases mainly emitted by agricultural activities.

Set 2

Ocean Acidification

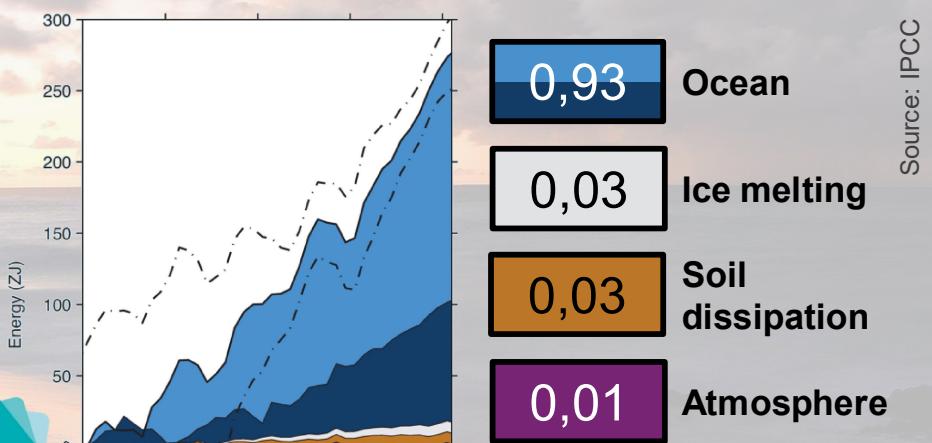


24

Aerosols

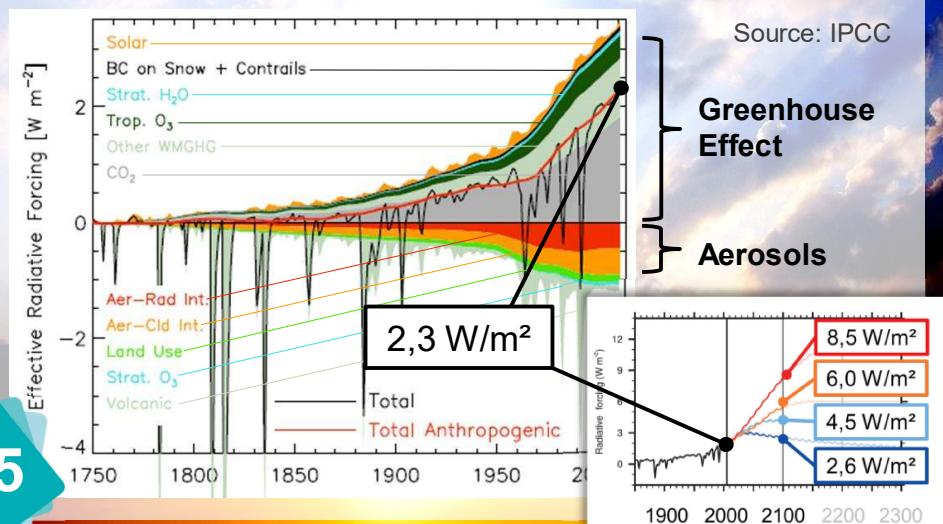
10

Energy Budget



14

Radiative Forcing



15

14



This graph explains where the energy accumulated on Earth due to radiative forcing goes: it warms up the ocean, melts ice, dissipates into the ground and warms up the atmosphere.

Set 3

24



When CO_2 dissolves in the ocean, it turns into acid ions (H_2CO_3 and HCO_3^-). The effect of this transformation is ocean acidification (the pH decreases).

Set 2

15



Radiative forcing represents the difference between the energy that arrives on Earth each second and the energy that is released. In the 5th assessment report of IPCC, the increase of radiative forcing from human activities since 1750 is estimated at 2.3 W/m^2 (Watts per square meter), with potentially much greater increases on the way if GHG emissions are not reduced.

Set 3

10

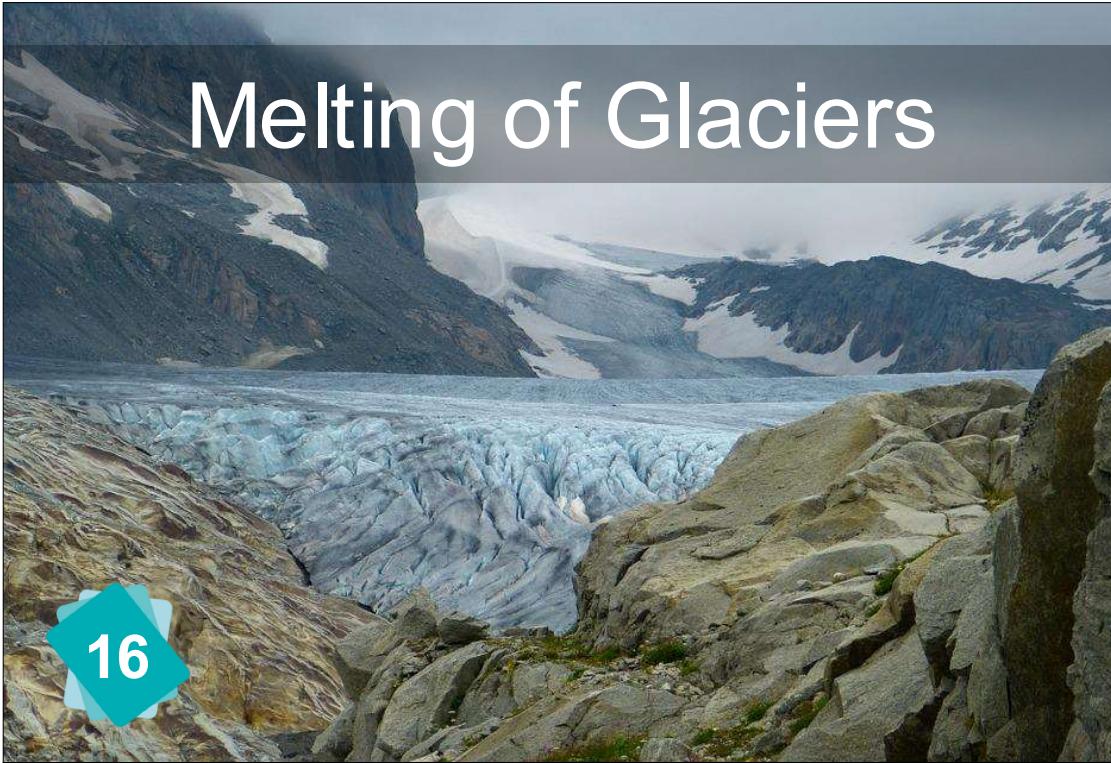


Nothing to do with aerosol spray cans. Aerosols are a type of local pollution that comes from the incomplete combustion of fossil fuels. They are bad for human health and they contribute negatively to radiative forcing (they cool the climate).

Set 3

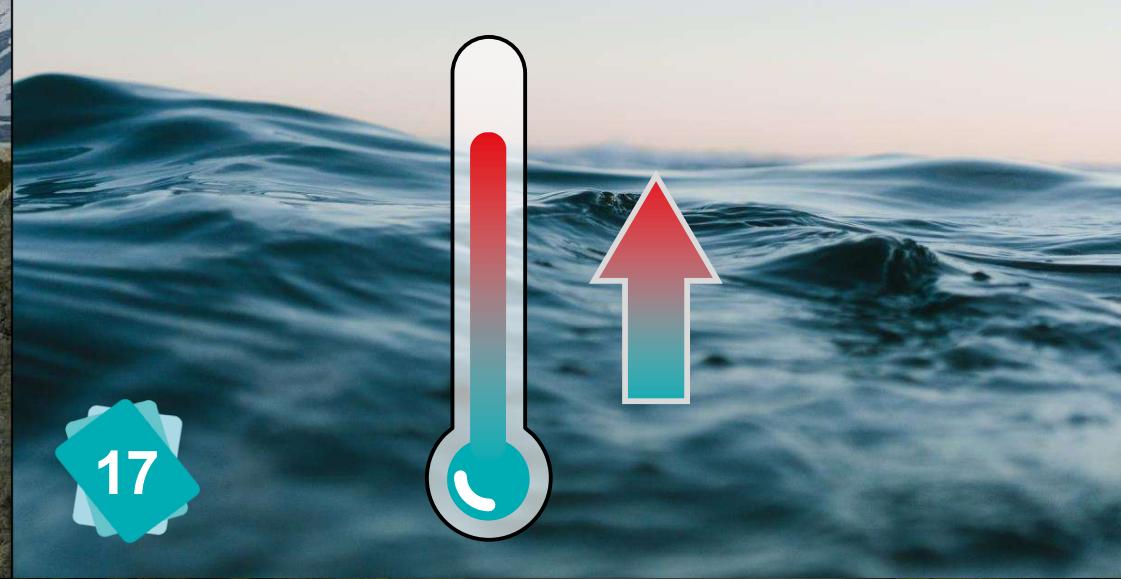
Melting of Glaciers

16

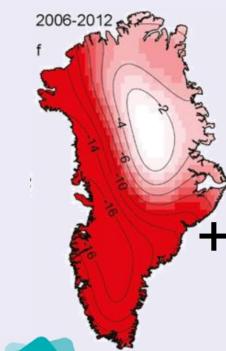


Increase in Water Temperature

17

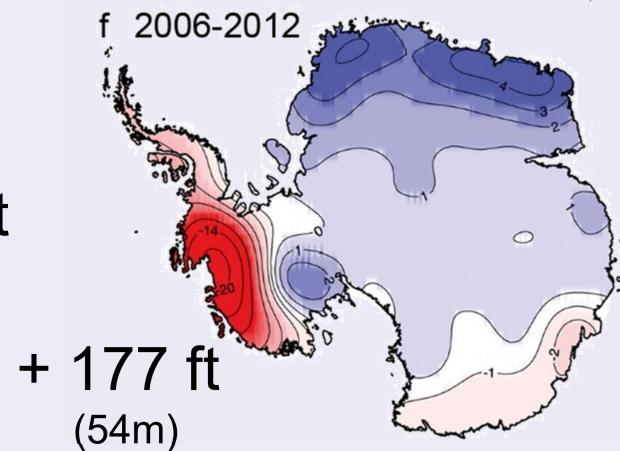


Melting of Ice Caps

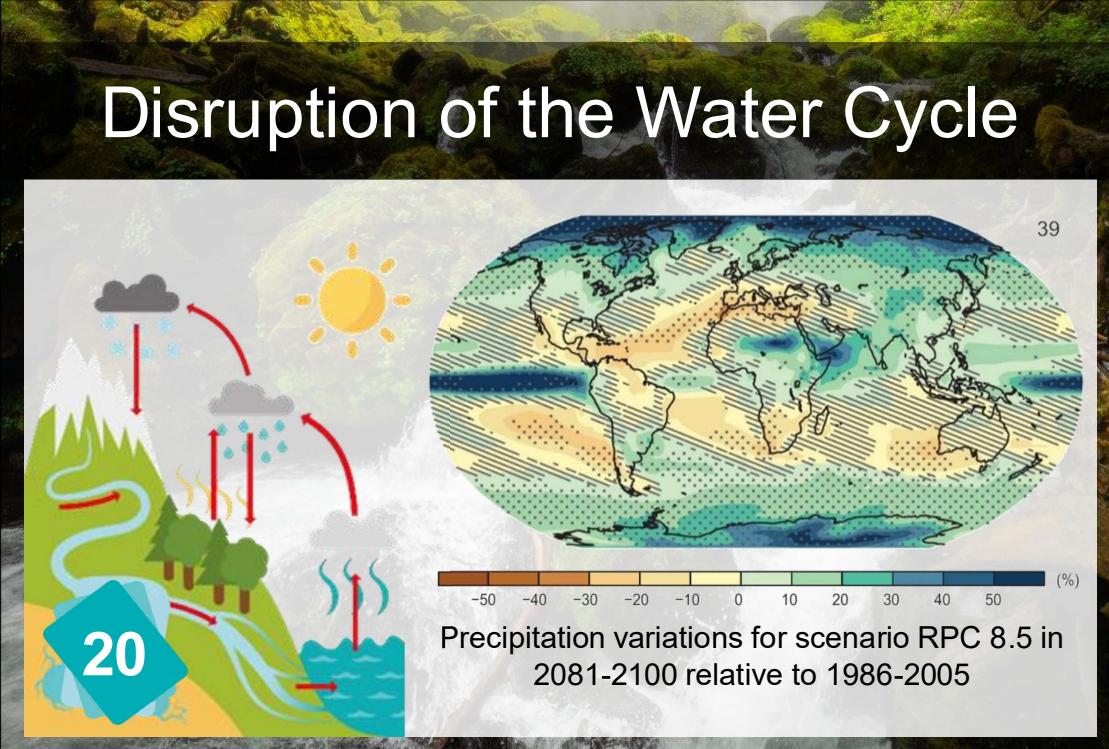


19

Source: IPCC



20



Precipitation variations for scenario RPC 8.5 in
2081-2100 relative to 1986-2005

19

Continental glaciers (or ice sheets) are in Greenland and Antarctica. If they were to melt completely, they would cause the ocean to rise by 23 feet (7 meters) for Greenland and 177 feet (54 meters) for Antarctica.

During the last ice age, ice caps were so much larger that the sea level was 390 feet (120 m) lower than today.

Set 3

16

Almost all glaciers have lost mass. Hundreds of them have already disappeared. These glaciers play a regulating role in the provision of fresh water.

Set 3

20

If the oceans and the atmosphere are hotter, the evaporation that takes place at the ocean surface increases. This means more rain clouds and more rain. If this happens on land, then the soil dries out.

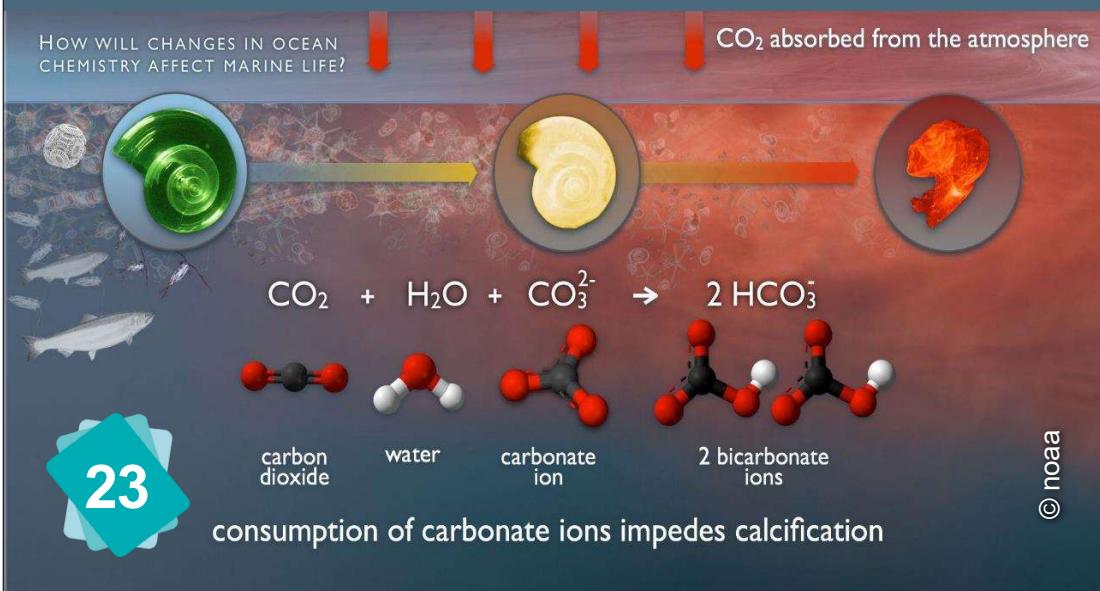
Set 3

17

Oceans absorb 93% of the energy accumulated on Earth. Their temperature has therefore increased, especially in the upper layers. The water expands as it warms up.

Set 3

Hindered calcification process



Terrestrial Biodiversity



25

River Flooding



26

Marine Biodiversity



27

26

The disruption of the water cycle can bring more water or less water. More water can lead to river flooding. If the soil has been dried out by a drought, it makes things worse because the water runs off.

Set 4

23

When the pH drops, the formation of calcium carbonate (and more specifically, of calcified shells) becomes more difficult.

Set 4

27

Pteropods and coccolithophores are at the base of the ocean food chain. Therefore, if they disappear, all marine biodiversity is threatened. The warming of ocean waters also threatens marine biodiversity.

Set 4

25

Animals and plants are affected by the changes in temperature and the disruption of the water cycle. They may migrate, become extinct or, more rarely, proliferate.

Set 4

Hurricanes

34



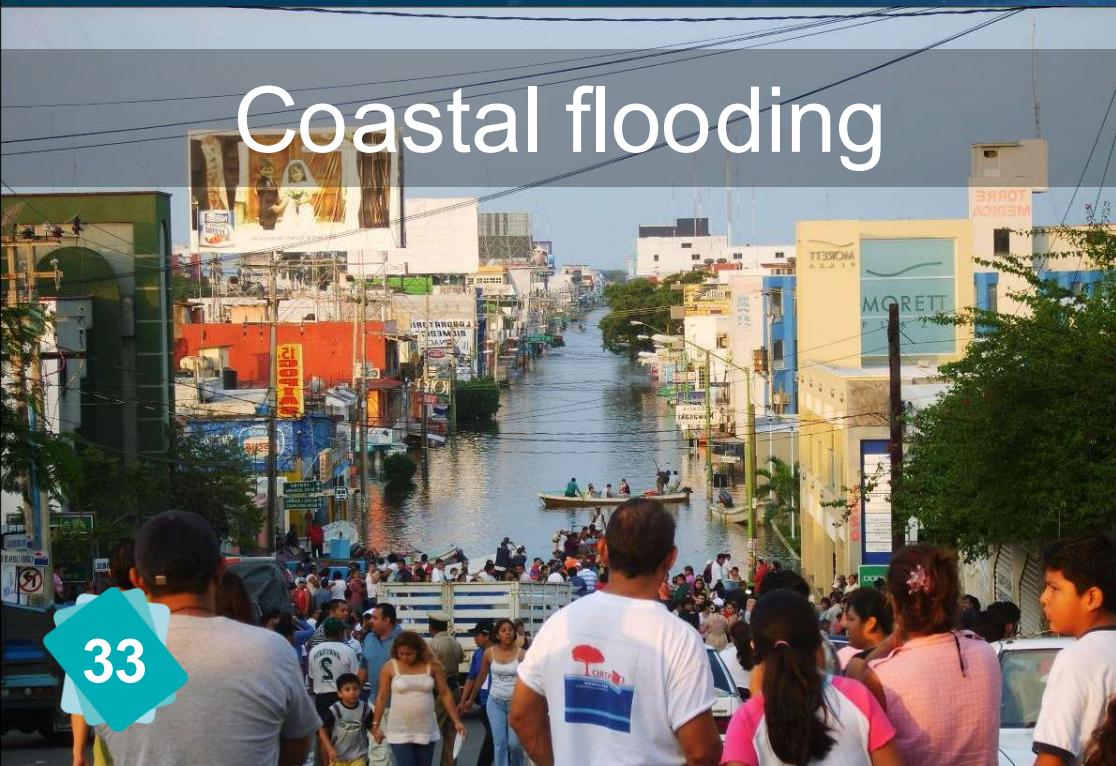
Droughts

30



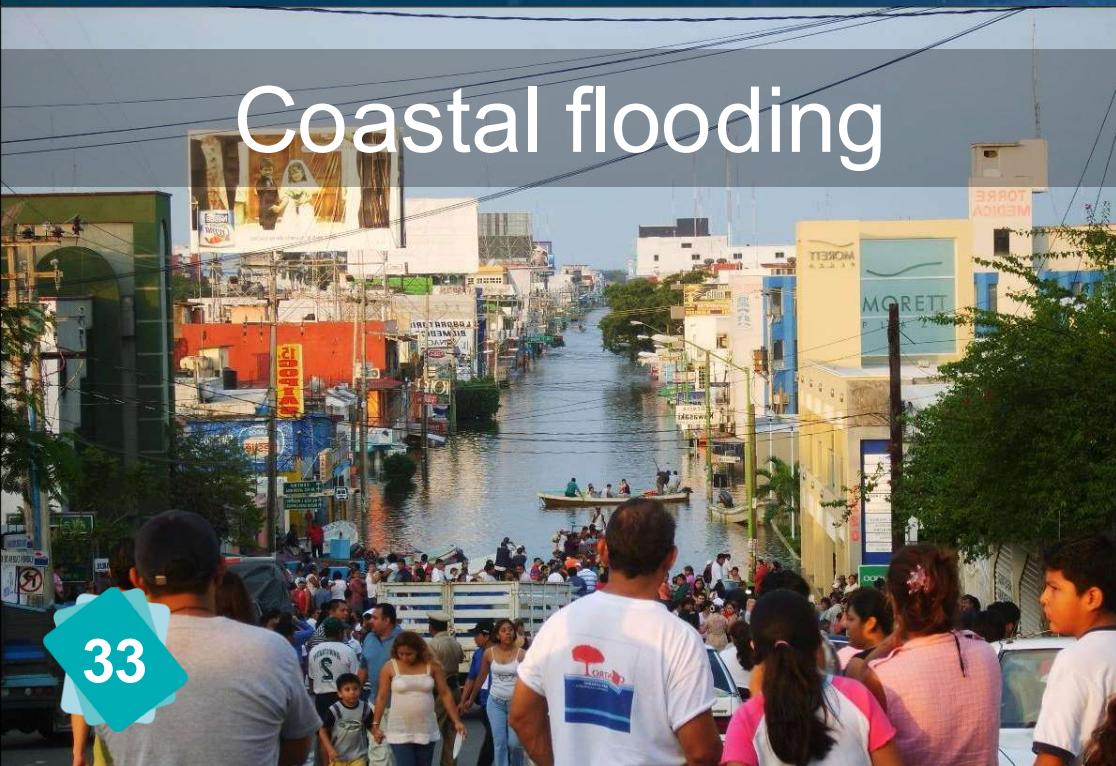
Pteropods and Coccolithophores

29



Coastal flooding

33



30

The disruption of the water cycle can bring more water or less water. Less water is a drought. Droughts are likely to become more frequent in the future.

Set 4

34

Hurricanes use energy from warm waters at the ocean surface. Because of global warming, they are becoming stronger.

Set 4



33

Hurricanes and weather disturbances cause wind, waves and low pressure conditions. A 1 mB (0,03 inHg) pressure decrease causes a 0.4 inch (1 cm) sea level rise. Therefore hurricanes can cause coastal flooding (or marine submersions), amplified by the sea level rise already caused by global warming.

Set 4

29

Pteropods are a kind of zooplankton and Coccolithophores a kind of phytoplankton. These organisms have a calcified shell.

Set 4

Vectors of Disease

28



Freshwater Resources

31



Decline in Agricultural Yields

32



Forest Fires

35



32

Food production can be affected by temperature, droughts, extreme weather events, floods and coastal flooding (e.g. the Nile Delta).

Set 5

28

With global warming, animals migrate. Some of them carry diseases and can reach areas where the population is not immunized against these diseases.

Set 5

35

Forest fires start more easily during droughts and heat waves.

Set 5

31

Freshwater resources are affected by changes in rainfall and by the disappearance of glaciers that regulate the flow of rivers.

Set 5

Heat Waves



36

Famines



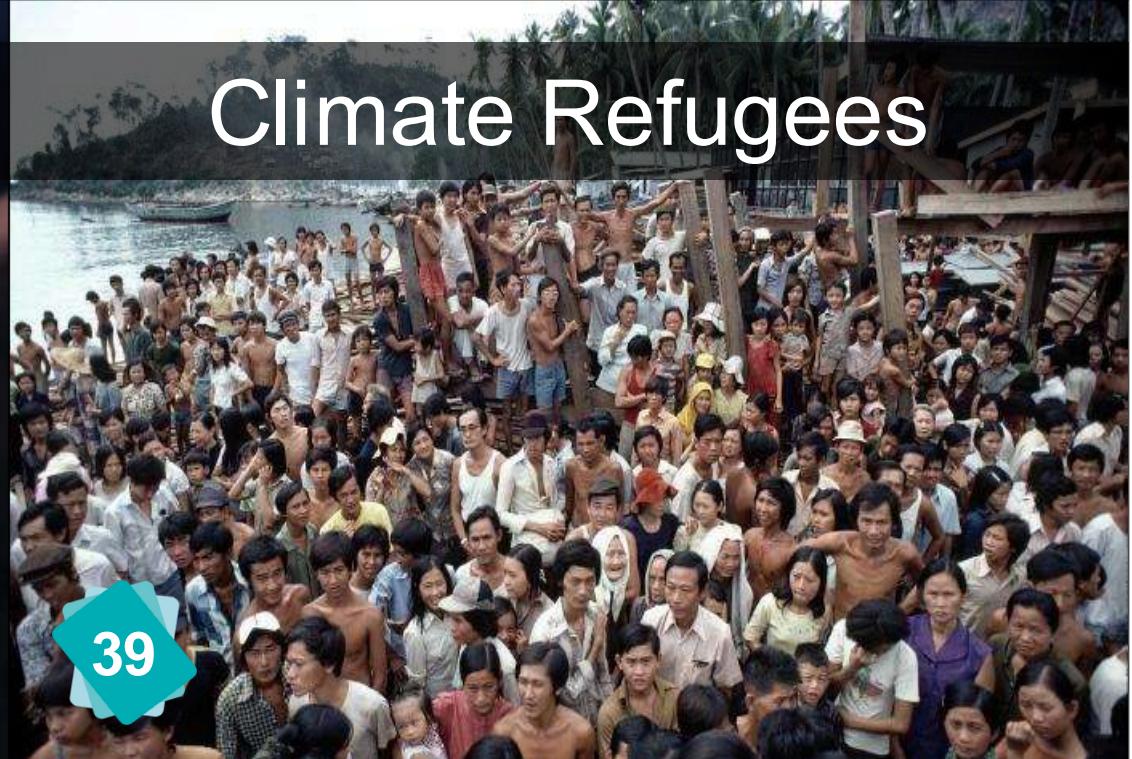
37

Human Health



38

Climate Refugees



39

38

Famines, migration of disease vectors, heat waves and armed conflicts can affect human health.

Set 5

36

A manifestation of temperature increase is the multiplication of heat waves.

Set 5

39

Imagine that you live in a place that has been miraculously spared by climate change. Several billions of human beings might want to share this space with you.

Set 5

37

Famines can be caused by lower agricultural yields and by the reduction of marine biodiversity.

Set 5

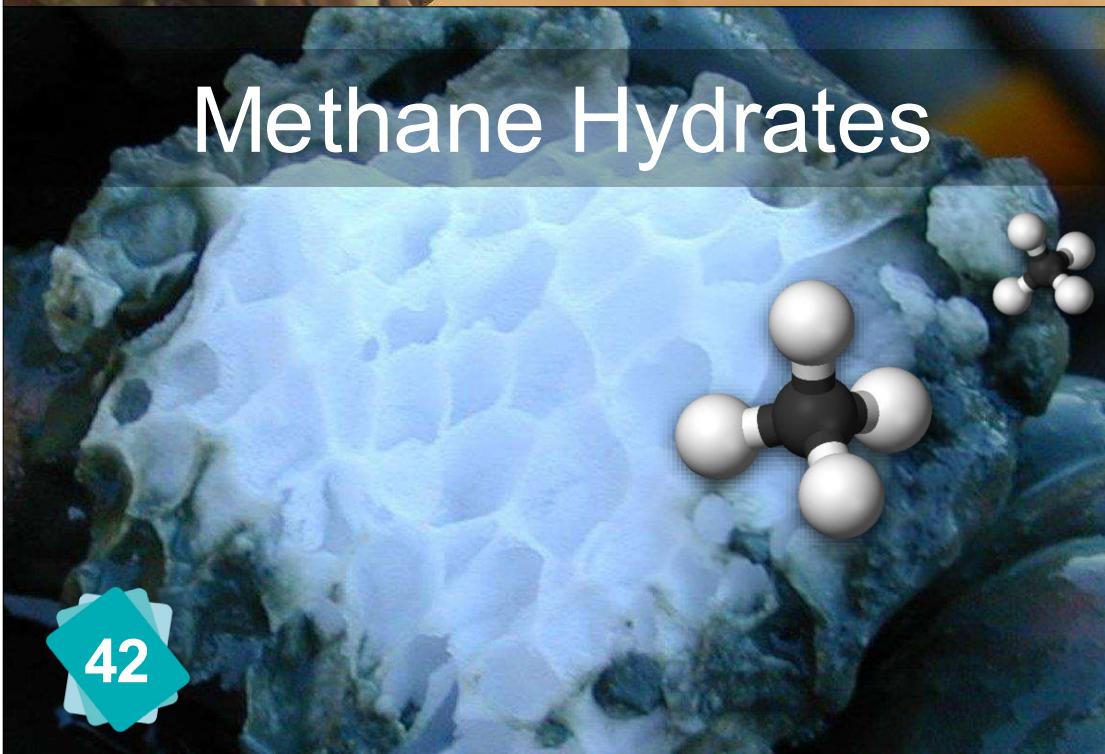
Armed Conflicts



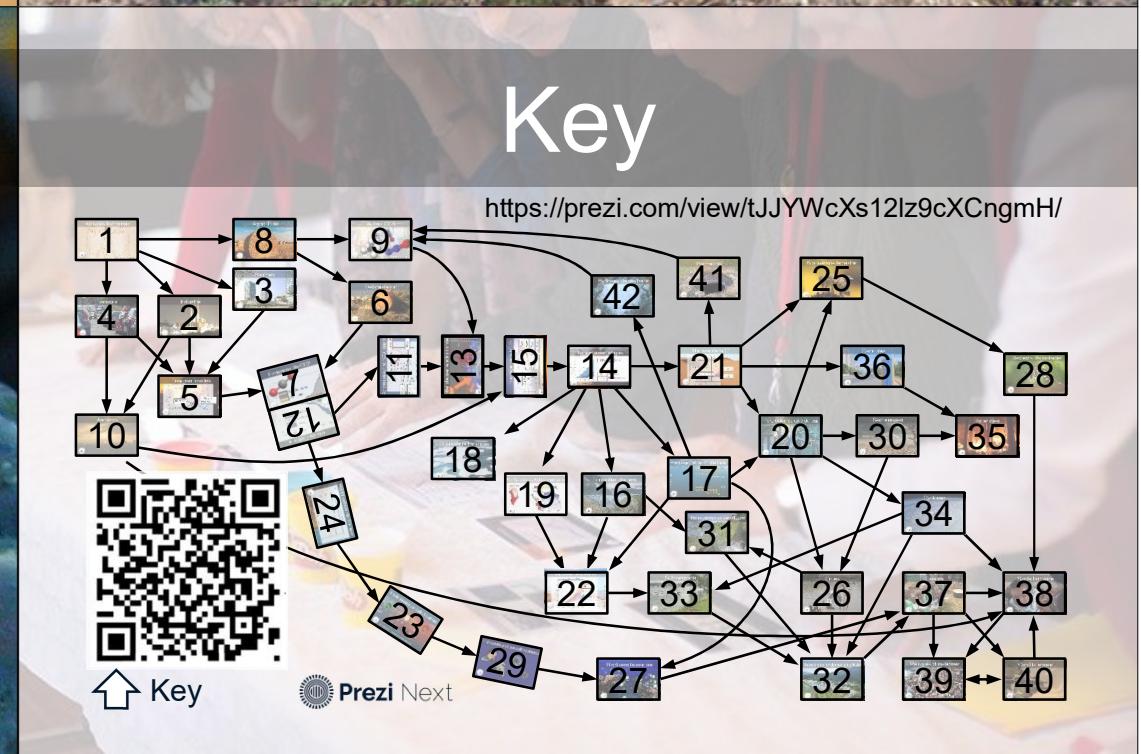
Permafrost



Methane Hydrates



Key



42

Methane hydrates (or methane clathrates) are a form of ice on the ocean floor, along continental slopes, that traps methane molecules. They can become unstable above +3.6°F (+2°C).

Set 5

40

This is how we don't want it to end...

Set 5

The Climate Fresk was developed by Cédric Ringenbach. Its distribution is managed by the non-profit association "La Fresque du Climat".

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Payment can be made at: <https://climatefresk.org/regler-vos-droits-dutilisation/>

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All the cards are in your hands!



 EN-GB

English



Scan to join us !

41

41

Permafrost is permanently frozen ground. Permafrost thawing leads to the decomposition of organic matter previously frozen underground, a phenomenon that releases methane and CO₂ into the atmosphere. Beyond +3.6°F (+2°C), it is almost certain this phenomenon will accelerate and make the climate spiral out of control.

Set 5