सत्यमेव जयते

Government of Puducherry
Department of Science, Technology and Environmen
Puducherry Climate Change Cell

Change for Climate Change

Presented By: Balaji. T

Junior Research Fellow
Puducherry Climate Change Cell

"Weather" ---- "Climate"

Weather is the temperature, precipitation and wind, which change hour by hour and day by day.

Climate is the average weather and its variations over time.
Long Term Weather Patterns of a region.

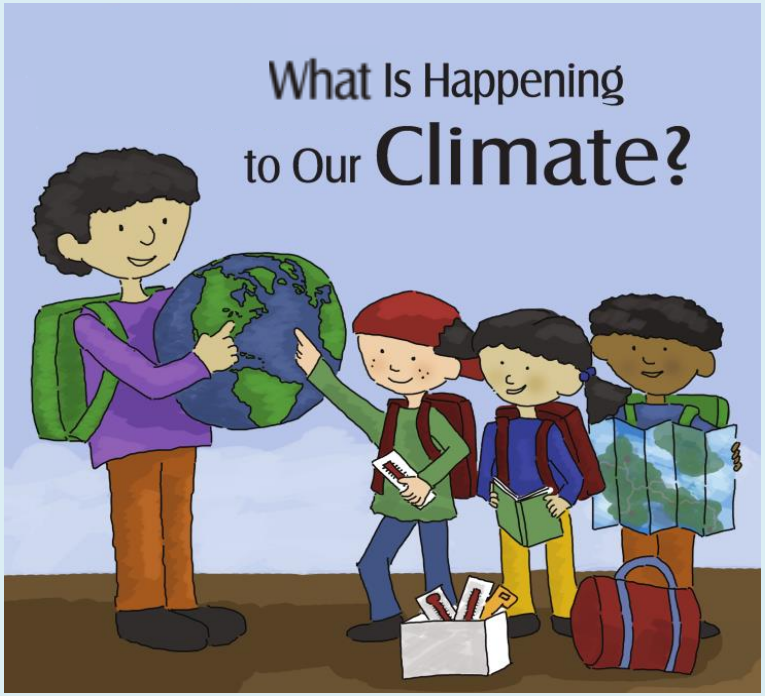
Climate Change

Climate Literacy

People of all backgrounds should participate.

- Scholar, Worker, Artist, Homemaker, Grandmother, a Just Born….

  Basically you have to be a responsible, aware, living being.

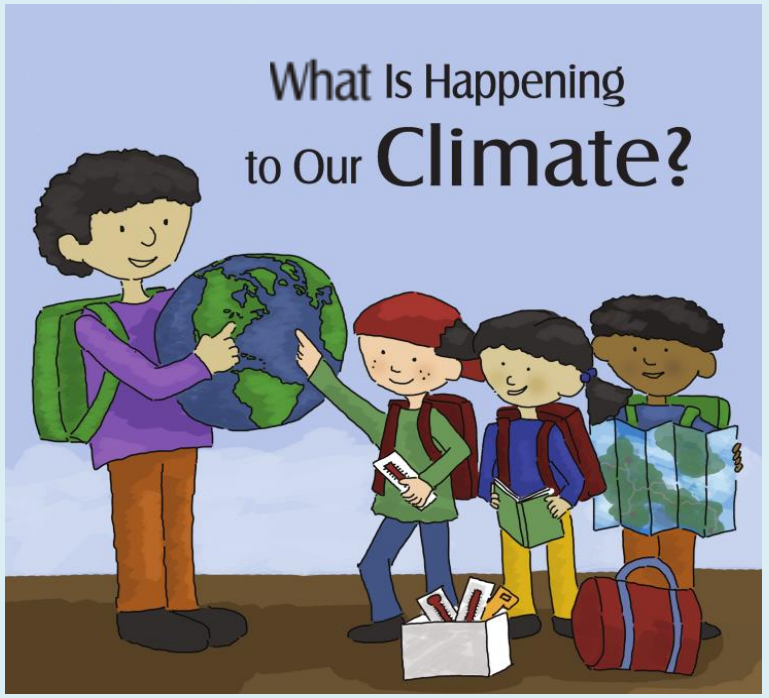


Look to mainstream yourself and your role / profession to Climate Change.

Climate Literacy

A Climate Literate Person will:

- ✓ Understand the principle of Climate Systems.
- ✓ Knows the scientifically credible Climate information.
- ✓ Communicates about Climate Change “scientifically”.
- ✓ Makes informed and responsible decisions w.r.t. Climate Change.



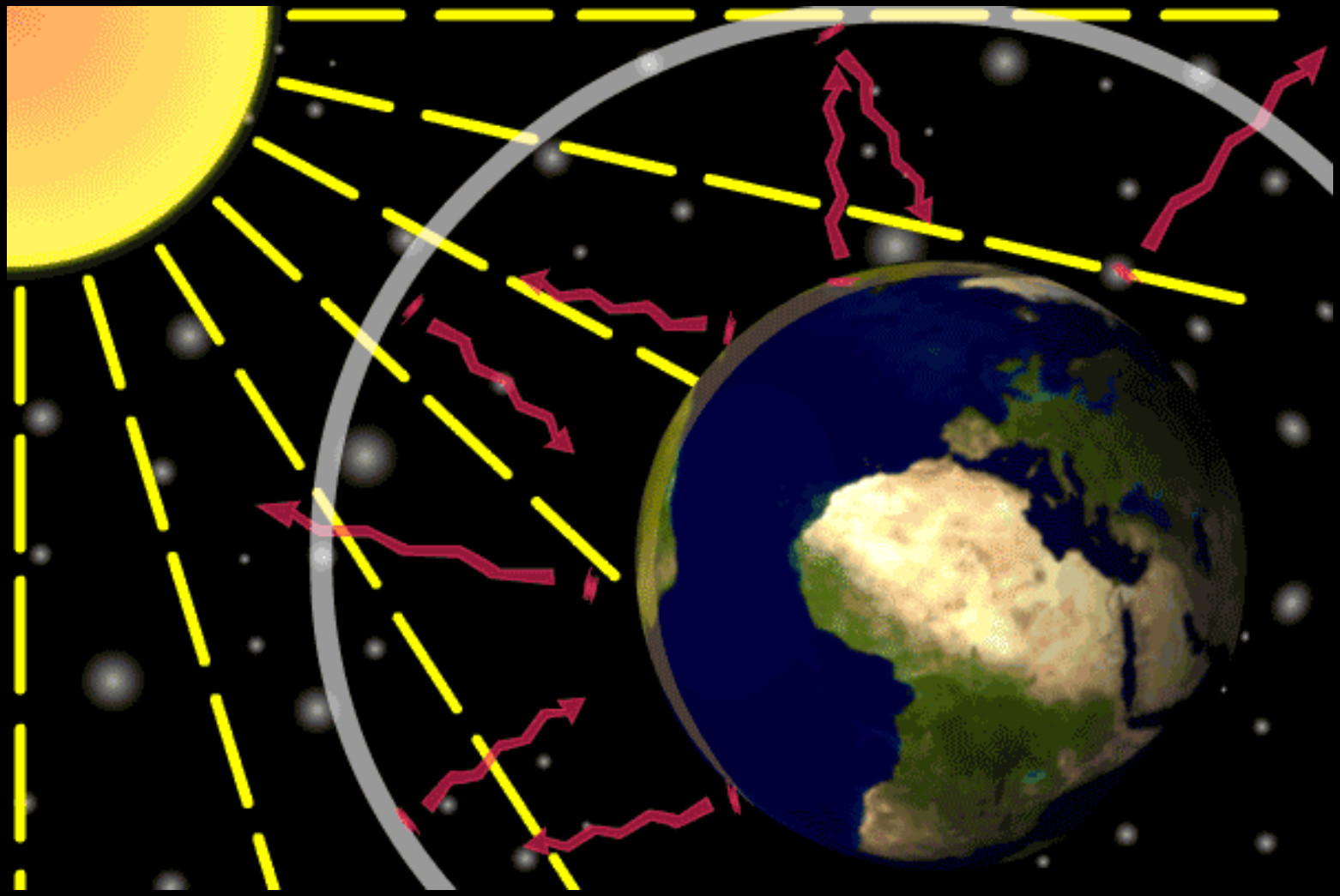
Climate Literacy

On symptoms, should not check up until the Doctor gives a negative report. When tested positive, we should take treatment.

- Simplest Climatological parameter: Temperature

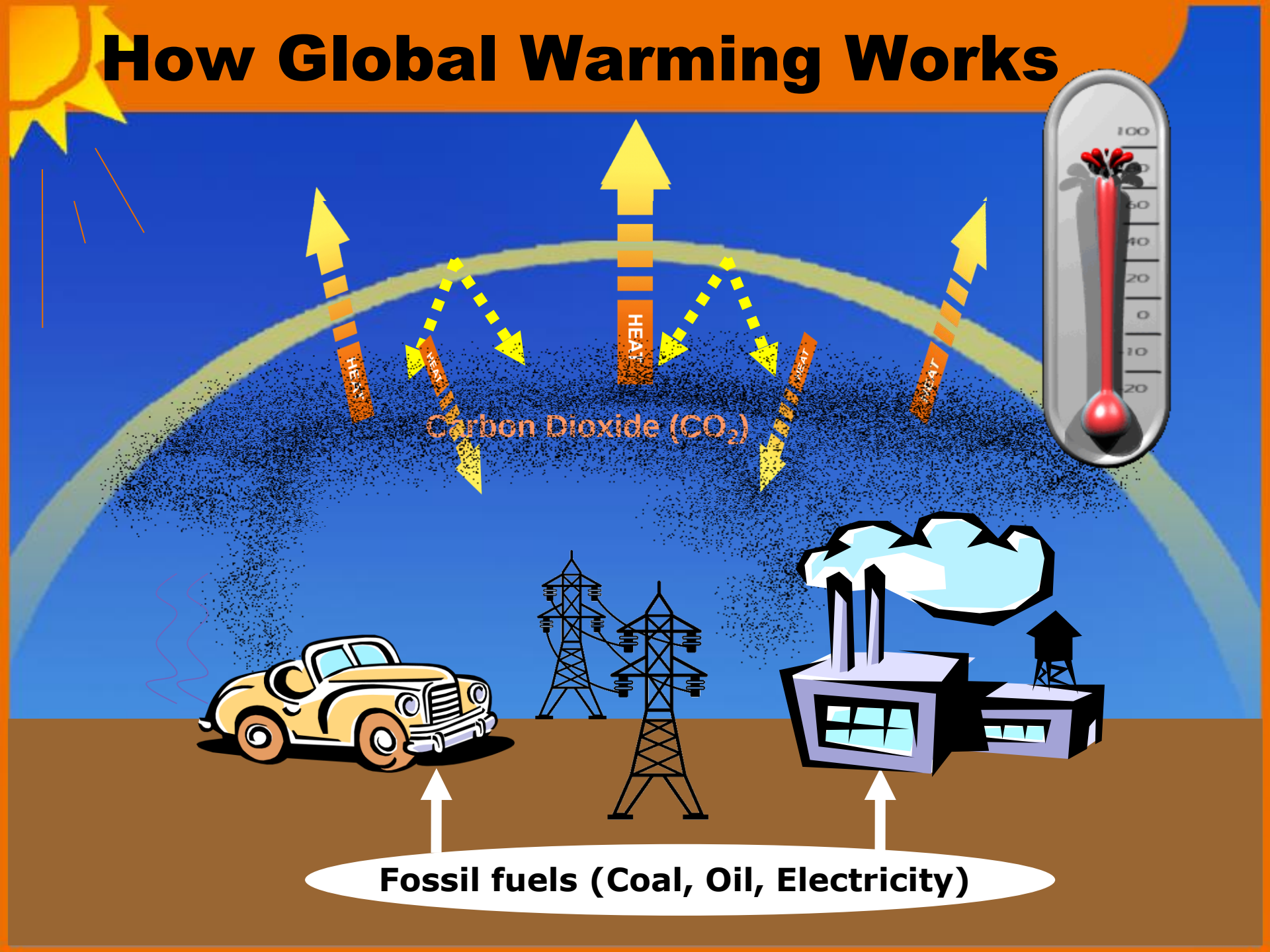
- Sustained increase in Temperature: Melts ice, Changes rainfall patterns, displaces humans, animals and plants, and a lots more.

Global Warming - Greenhouse Effect




The Greenhouse Effect
Atmosphere
climate.nasa.gov

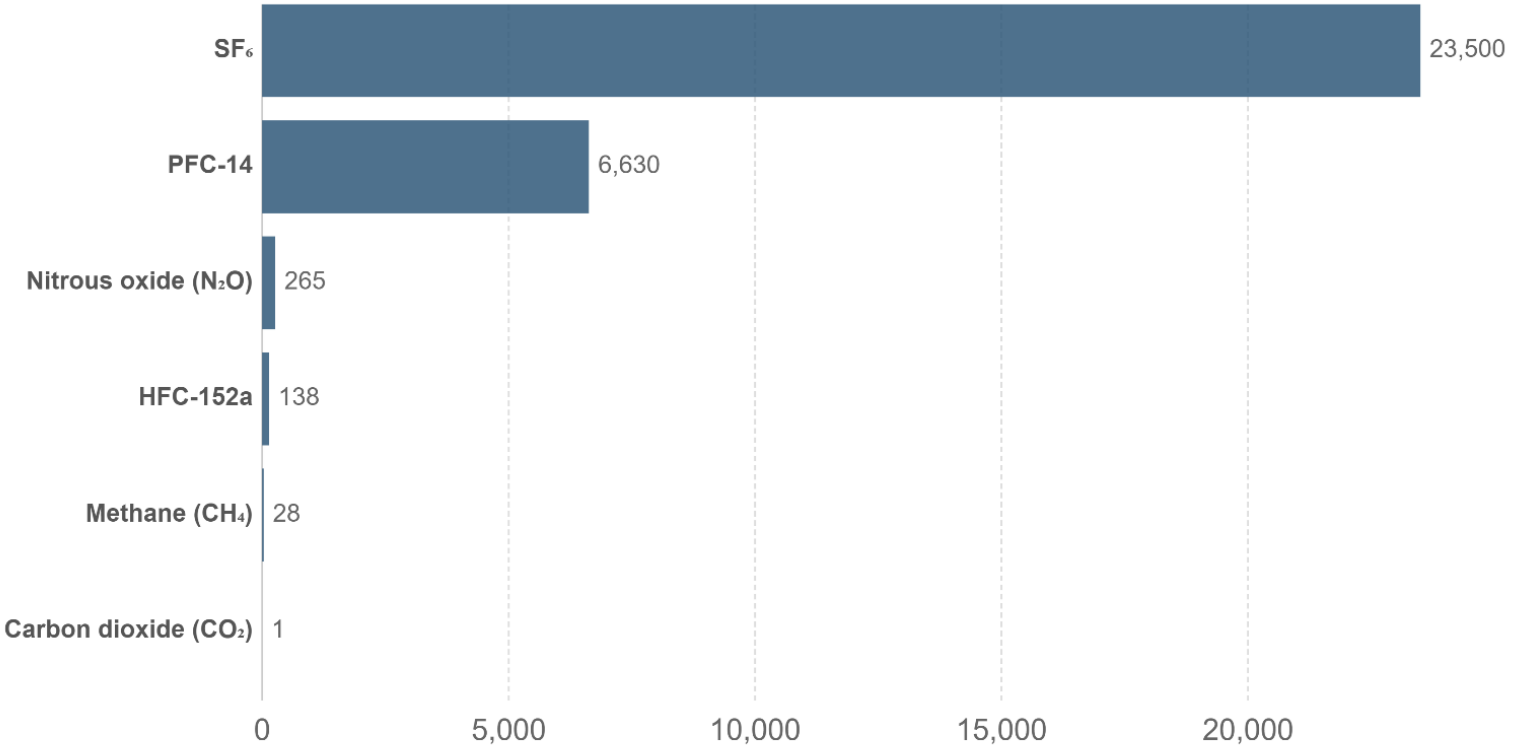
How Global Warming Works



Global warming potential of greenhouse gases over 100-year timescale (GWP_{100})

Our World in Data

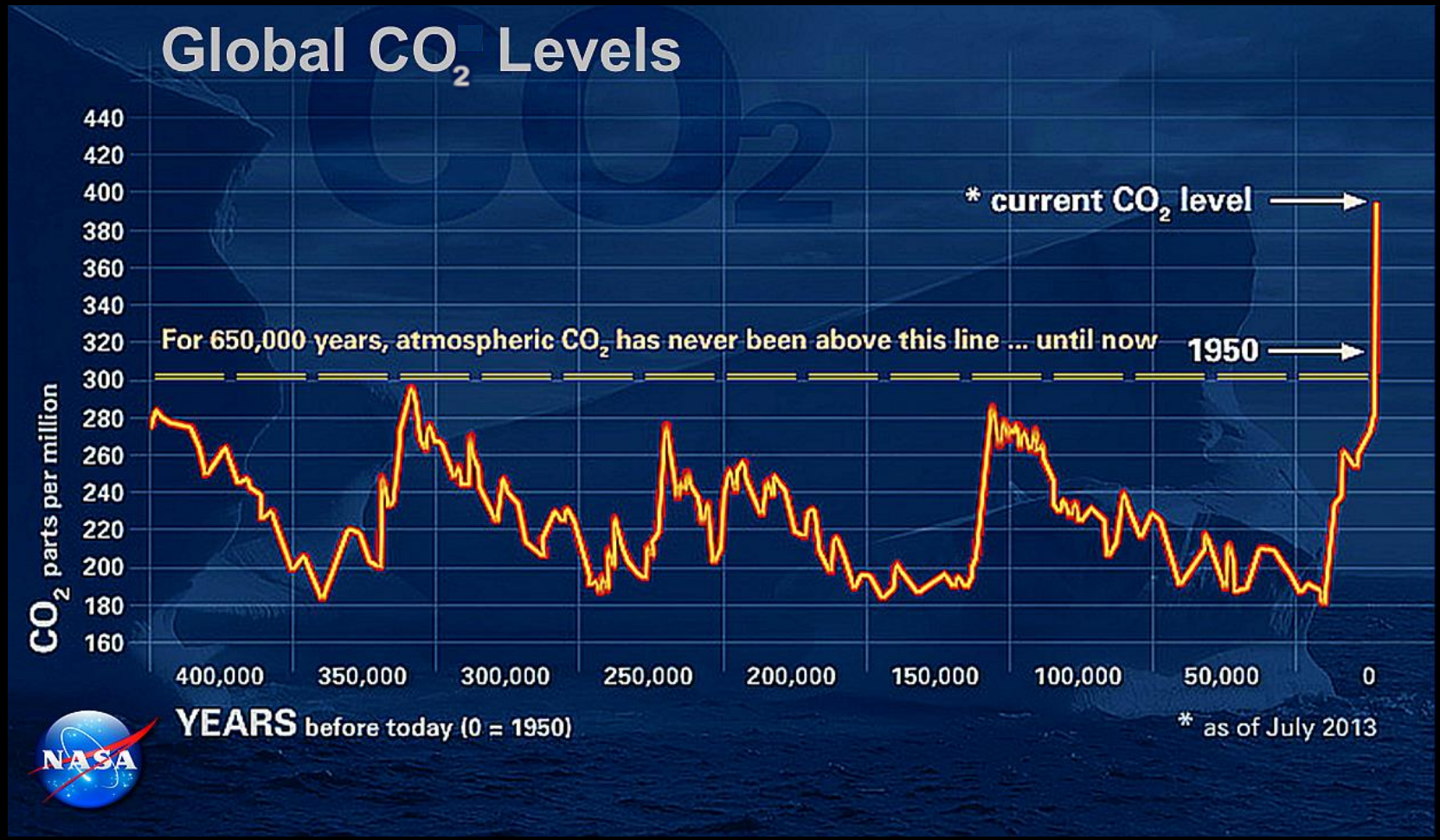
GWP measures the relative warming impact of one unit mass of a greenhouse gas relative to carbon dioxide. A GWP_{100} value of 28 therefore means one tonne of methane has 28 times the warming impact of one tonne of carbon dioxide over a 100-year timescale. These figures do not include climate change feedback effects.



Source: IPCC, 2014: Climate Change 2014: Synthesis Report. Contribution of Working Groups I, II and III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change


CO_2

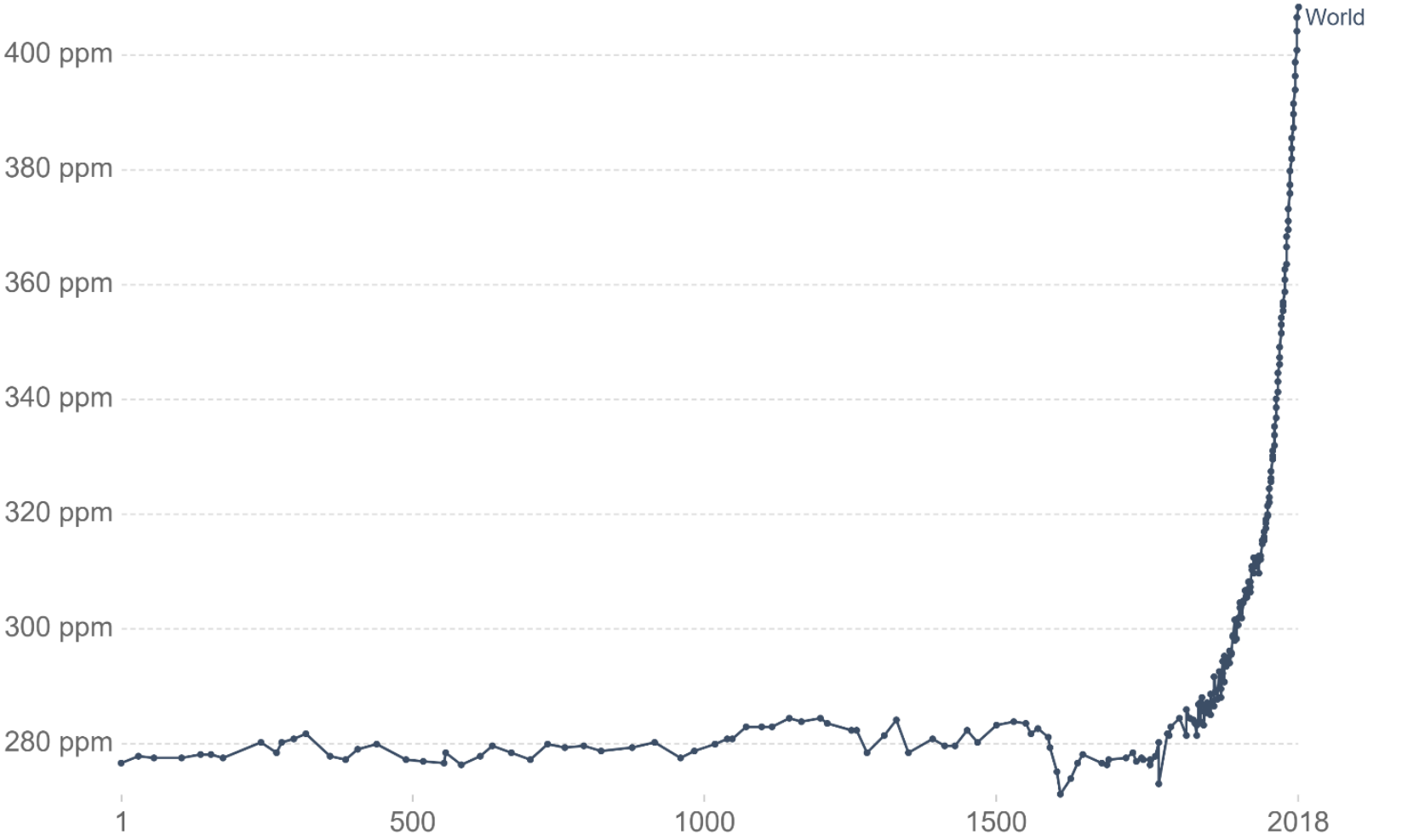
Carbon Historical Graph



Global CO_2 atmospheric concentration

Global mean annual concentration of carbon dioxide (CO_2) measured in parts per million (ppm).

Our World in Data

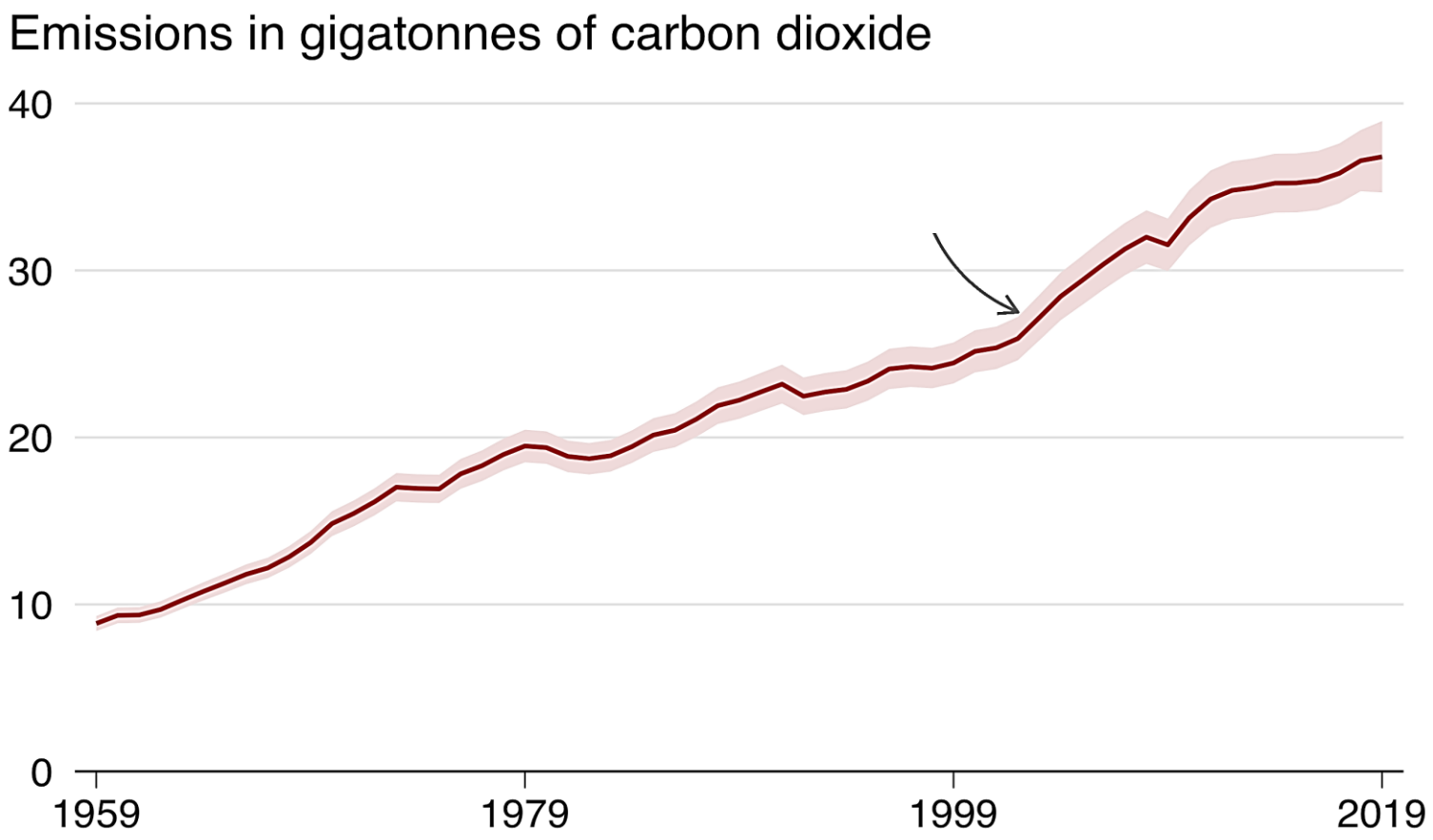


Source: NOAA/ESRL (2018)

OurWorldInData.org/co2-and-other-greenhouse-gas-emissions/ • CC BY

Global CO_2 Emissions: 36 Gigatons

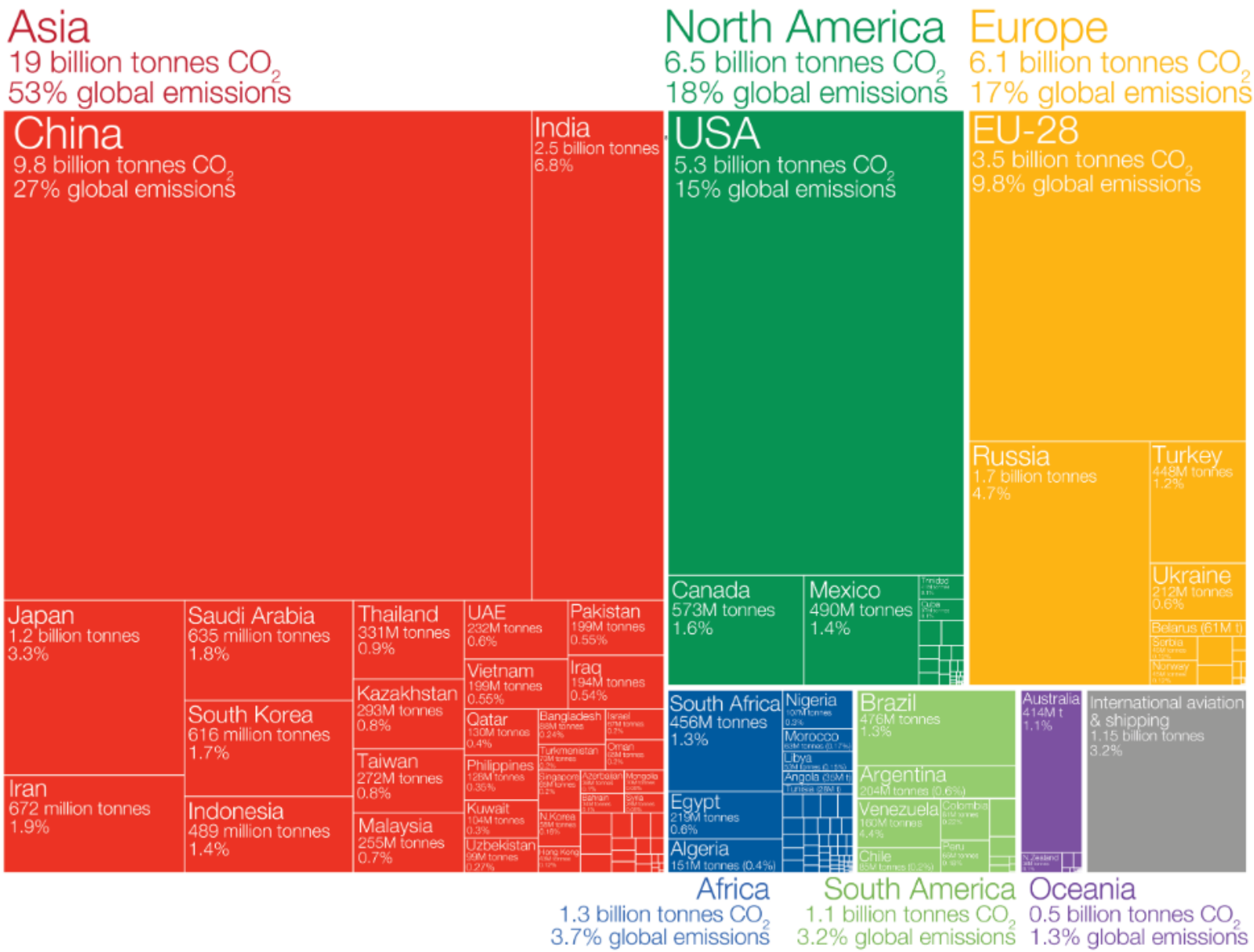
(2018)



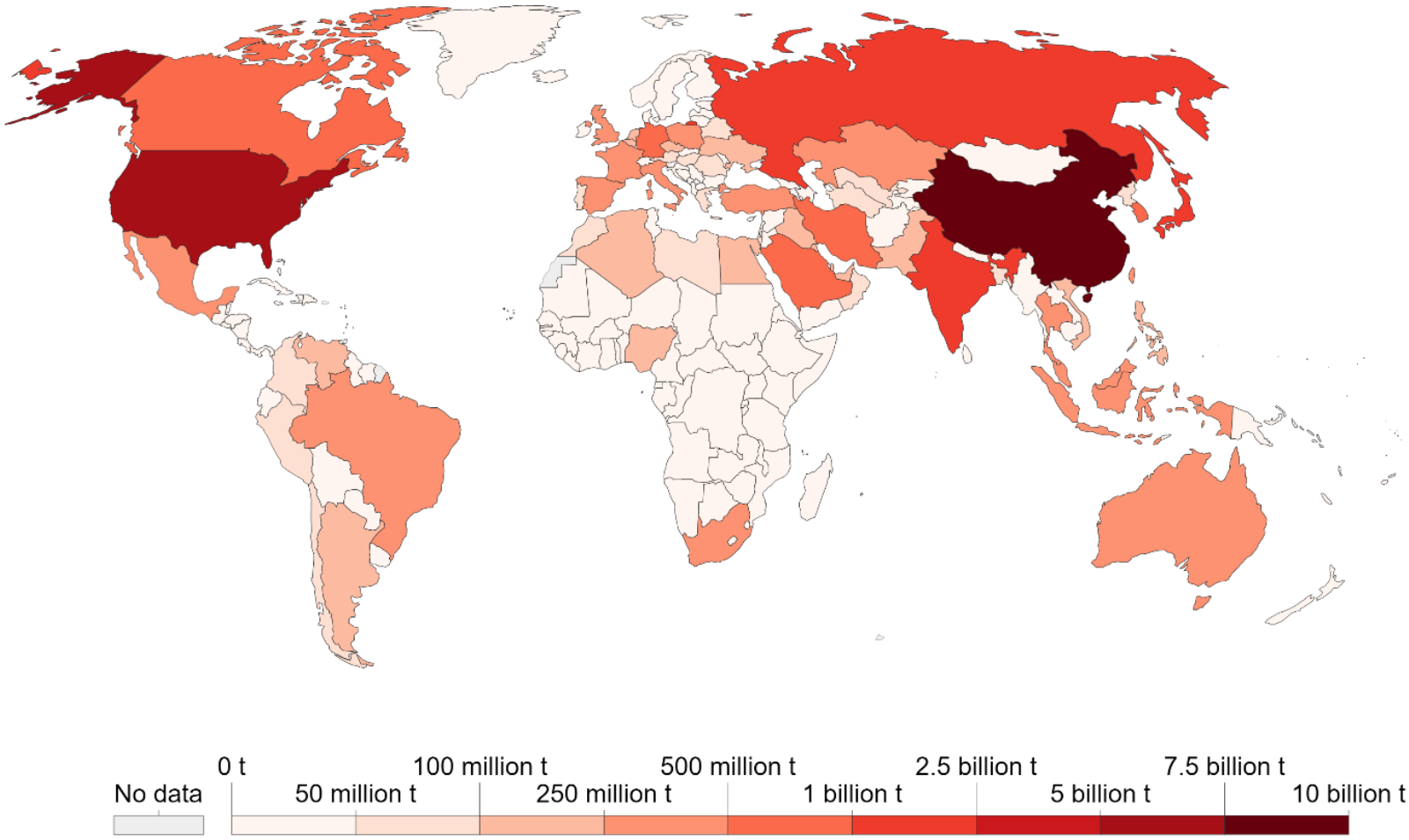
Who emits the most CO_2?

Global carbon dioxide (CO_2) emissions were 36.2 billion tonnes in 2017.

Our World in Data

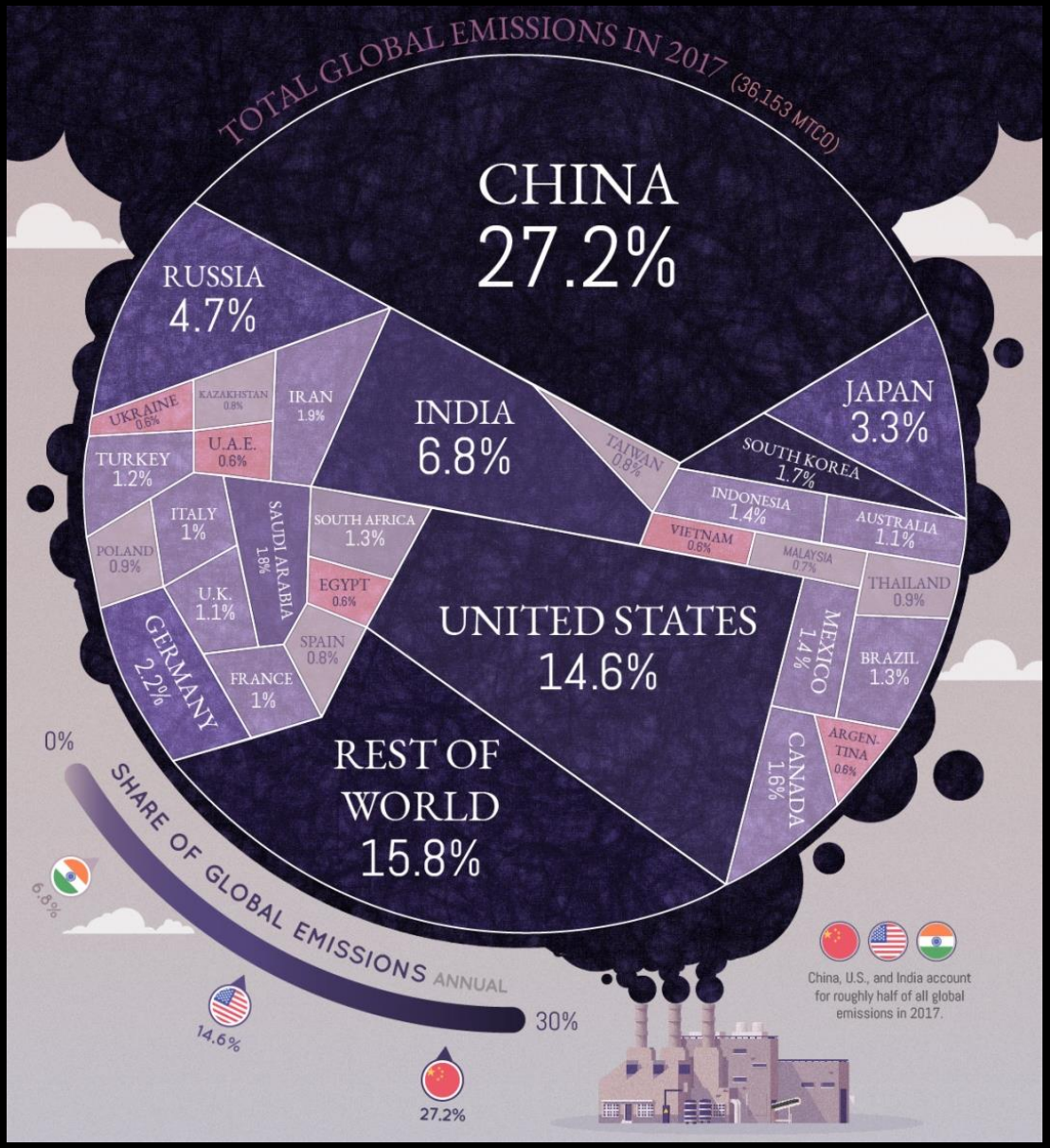


Annual CO_2 Emissions, 2017

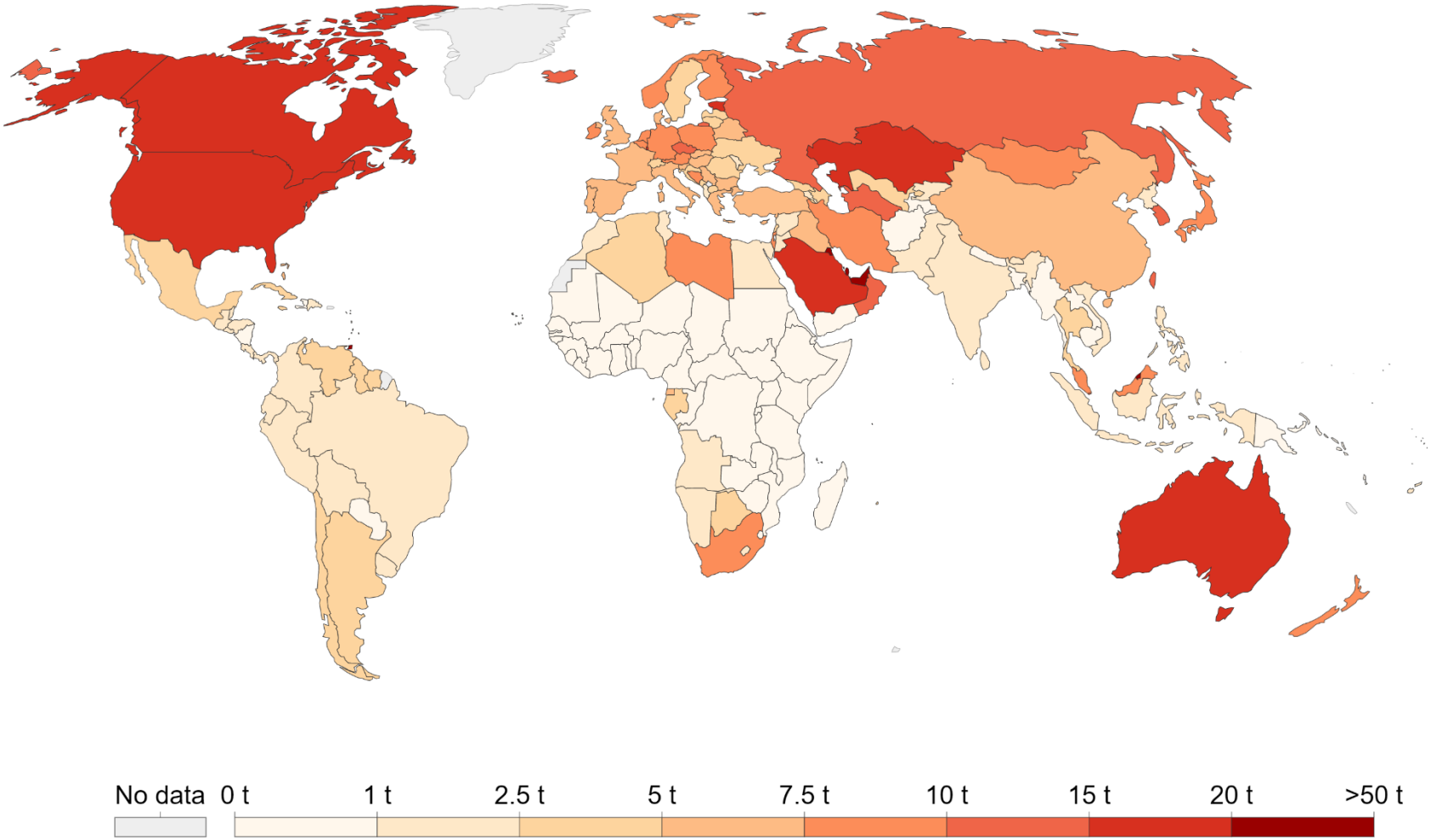


Source: Global Carbon Project; Carbon Dioxide Information Analysis Centre (CDIAC)
OurWorldInData.org/co2-and-other-greenhouse-gas-emissions/ • CC BY

Percentage of CO_2 Emission by Countries

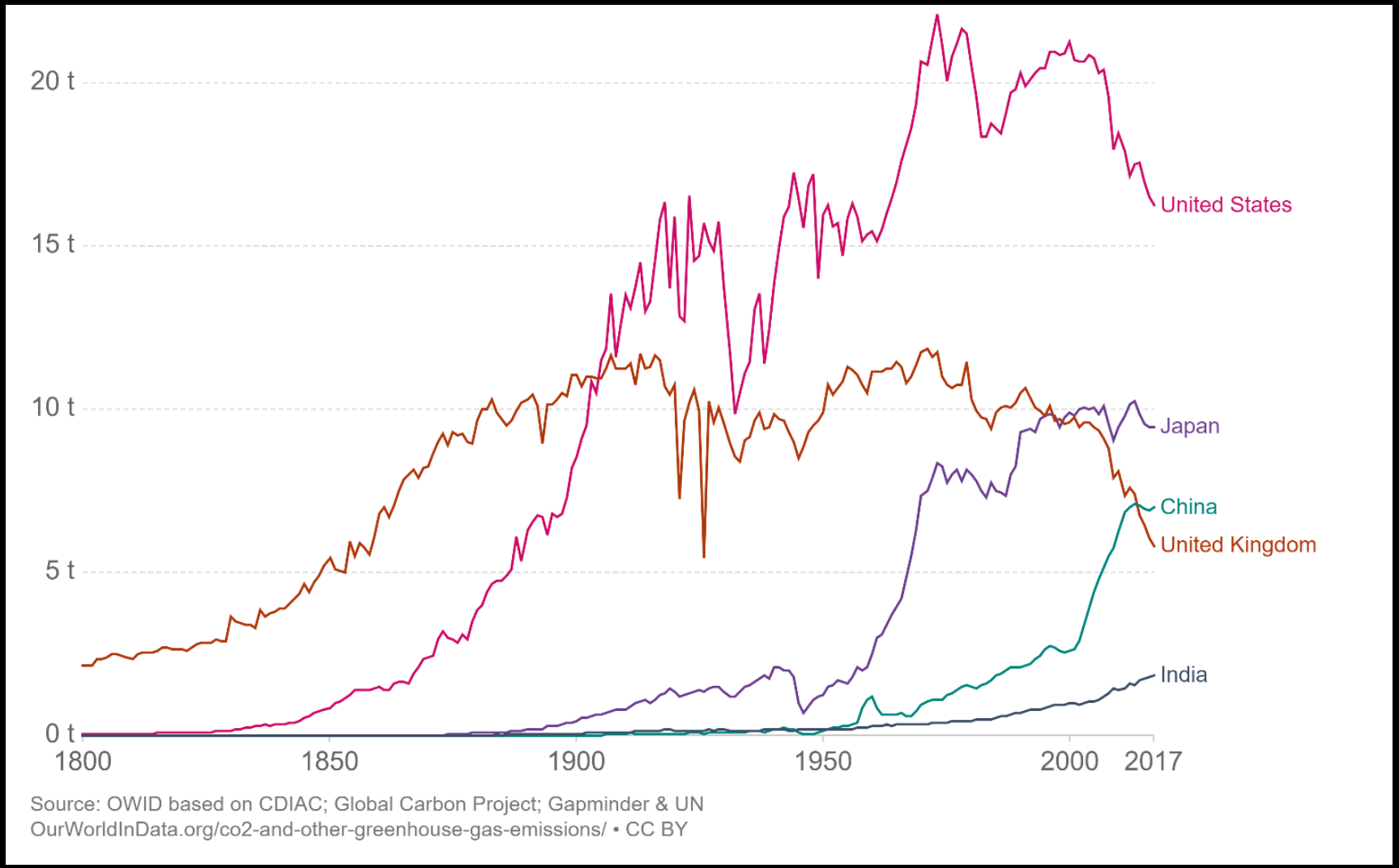


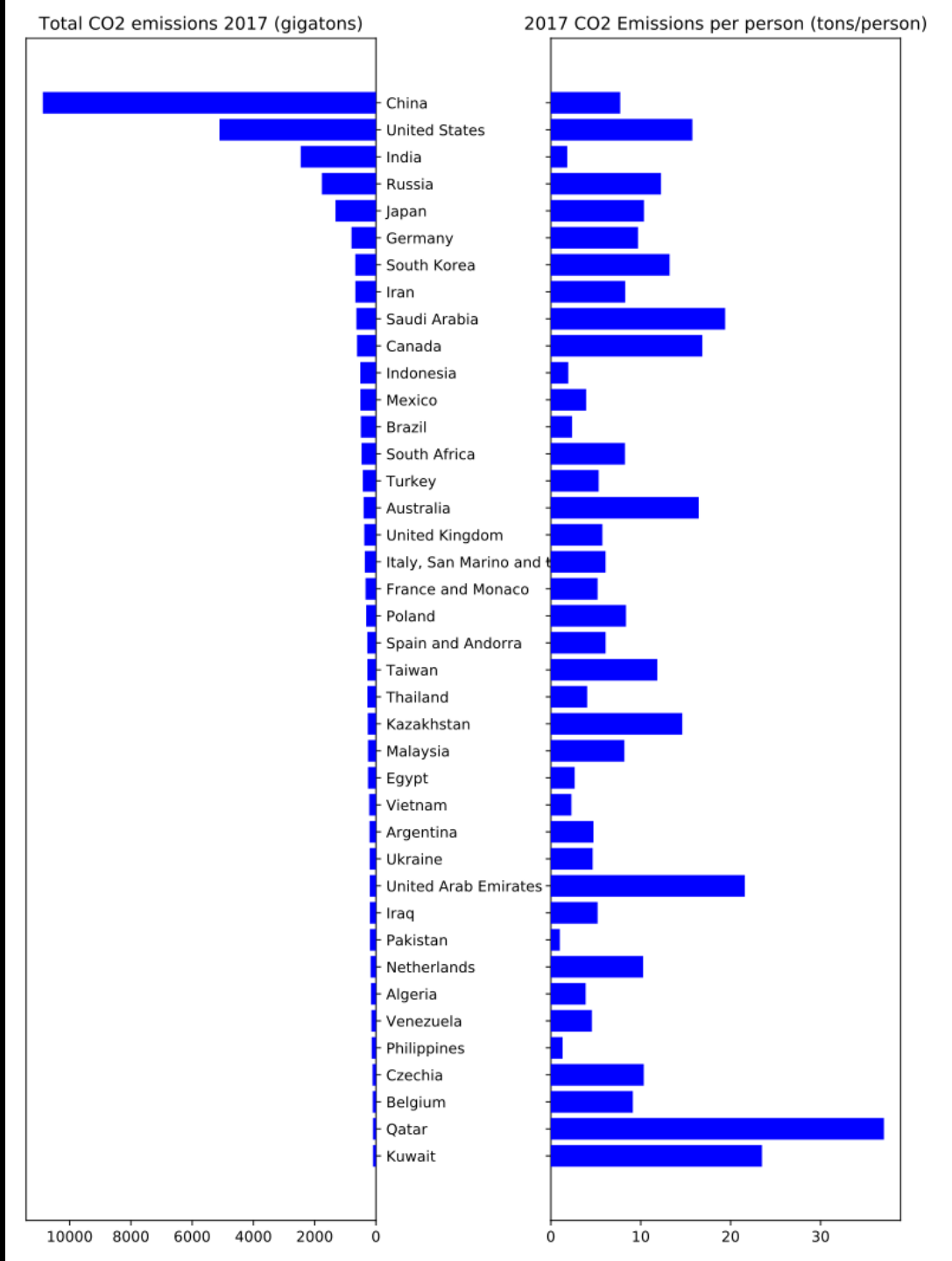
CO_2 Emissions Per Capita, 2017

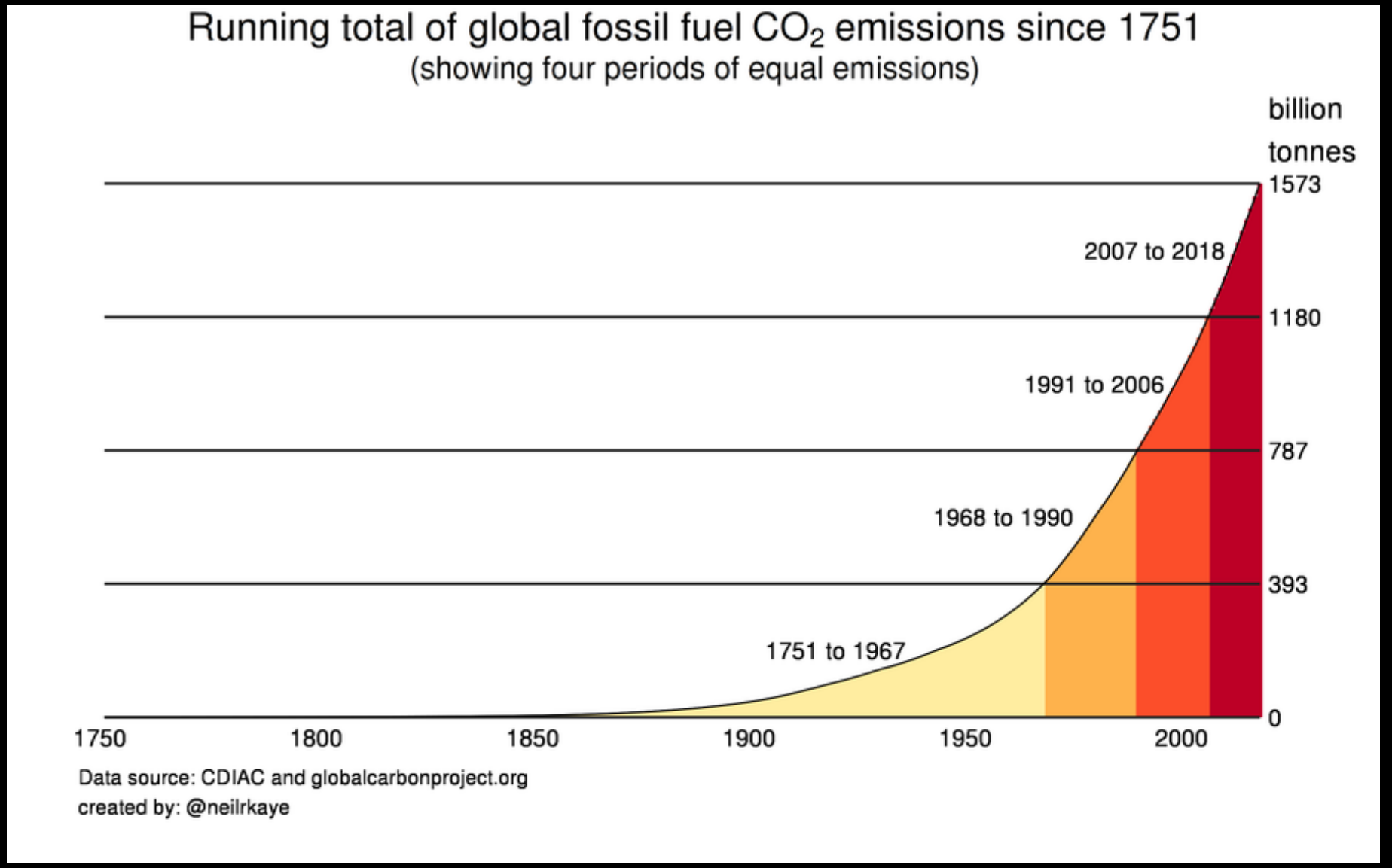


Source: OWID based on CDIAC; Global Carbon Project; Gapminder & UN
OurWorldInData.org/co2-and-other-greenhouse-gas-emissions/ • CC BY

CO_2 Emissions Per Capita, 2017




Total CO2 emissions 2017 (gigatons)
2017 CO2 Emissions per person (tons/person)
China
United States
India
Russia
Japan
Germany
South Korea
Iran
Saudi Arabia
Canada
Indonesia
Mexico
Brazil
South Africa
Turkey
Australia
United Kingdom
Italy, San Marino and t
France and Monaco
Poland
Spain and Andorra
Taiwan
Thailand
Kazakhstan
Malaysia
Egypt
Vietnam
Argentina
Ukraine
United Arab Emirates
Iraq
Pakistan
Netherlands
Algeria
Venezuela
Philippines
Czechia
Belgium
Qatar
Kuwait
10000
8000
6000
4000
2000
0
0
10
20
30


Running total of global fossil fuel CO_2 emissions since 1751
(showing four periods of equal emissions)
billion
tonnes
1573
1180
787
393
0
2007 to 2018
1991 to 2006
1968 to 1990
1751 to 1967
1750
1800
1850
1900
1950
2000
Data source: CDIAC and globalcarbonproject.org
created by: @neilrkaye

Climate Change Effects!

Severe Storms

Ice Melt

Heavy Downpours

Precipitation

Temperature

Sea Level

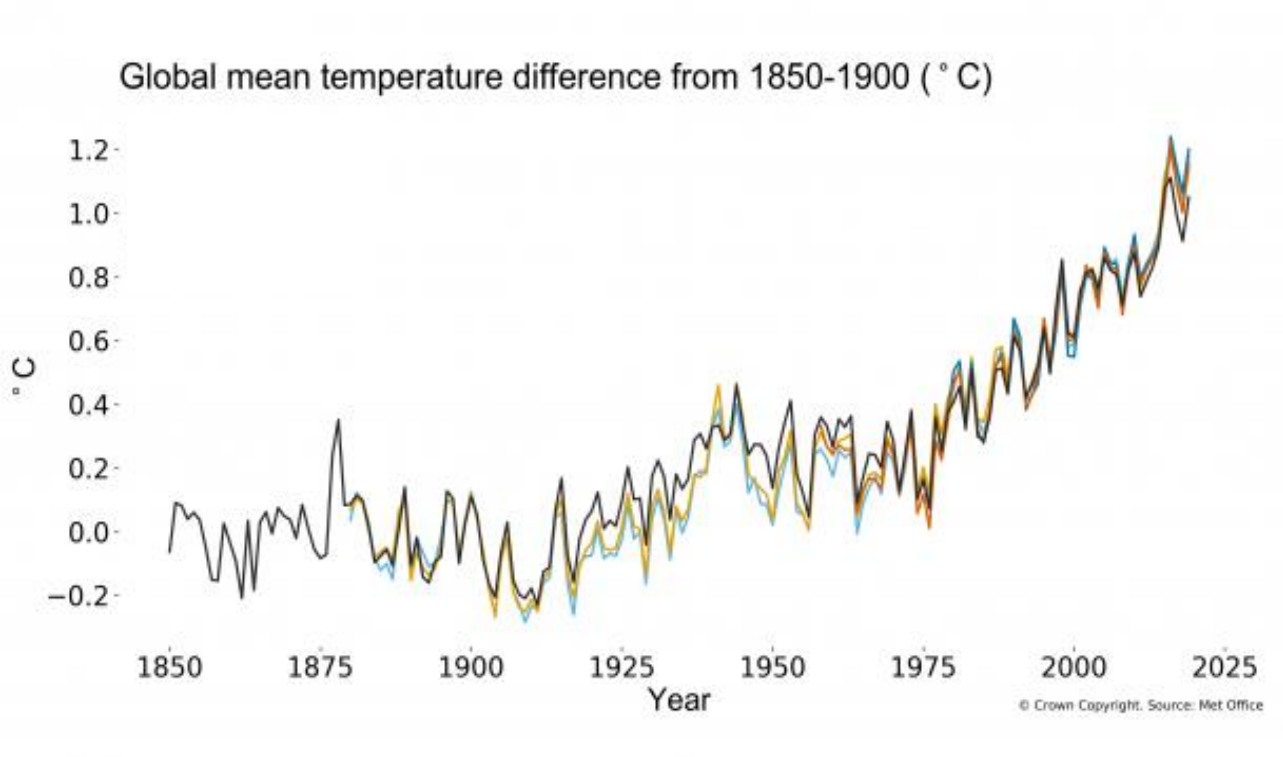
Ocean Acidification

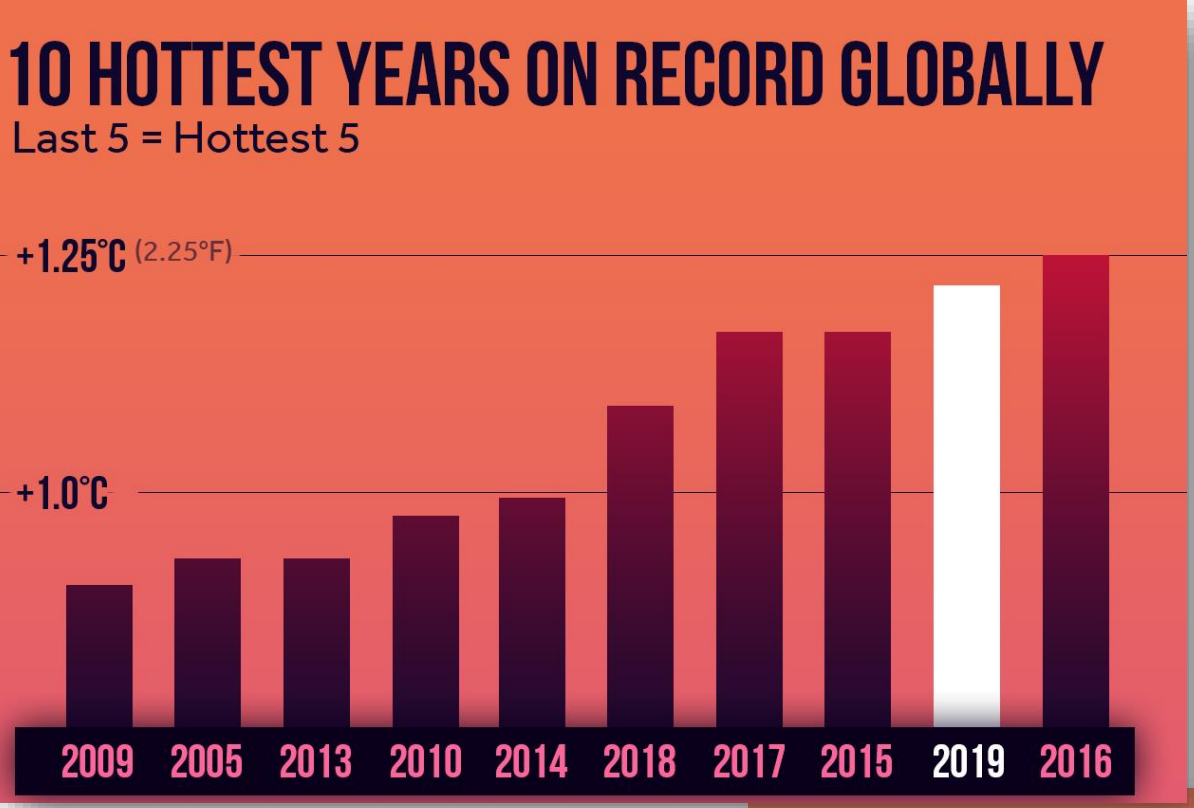
Extreme Weather

Wildfire

Temperature

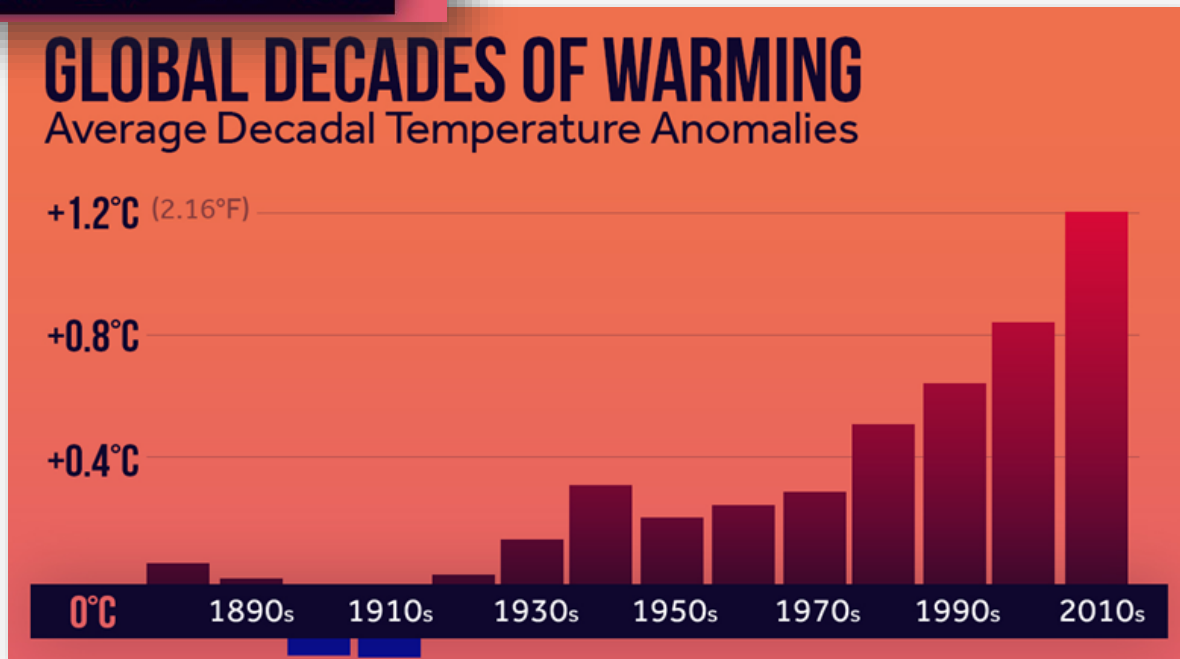
- Human activities have led to over 1^0C of global warming above pre-industrial levels.
- Goal under Paris Agreement: < 2^0C degree (1.5^0C)



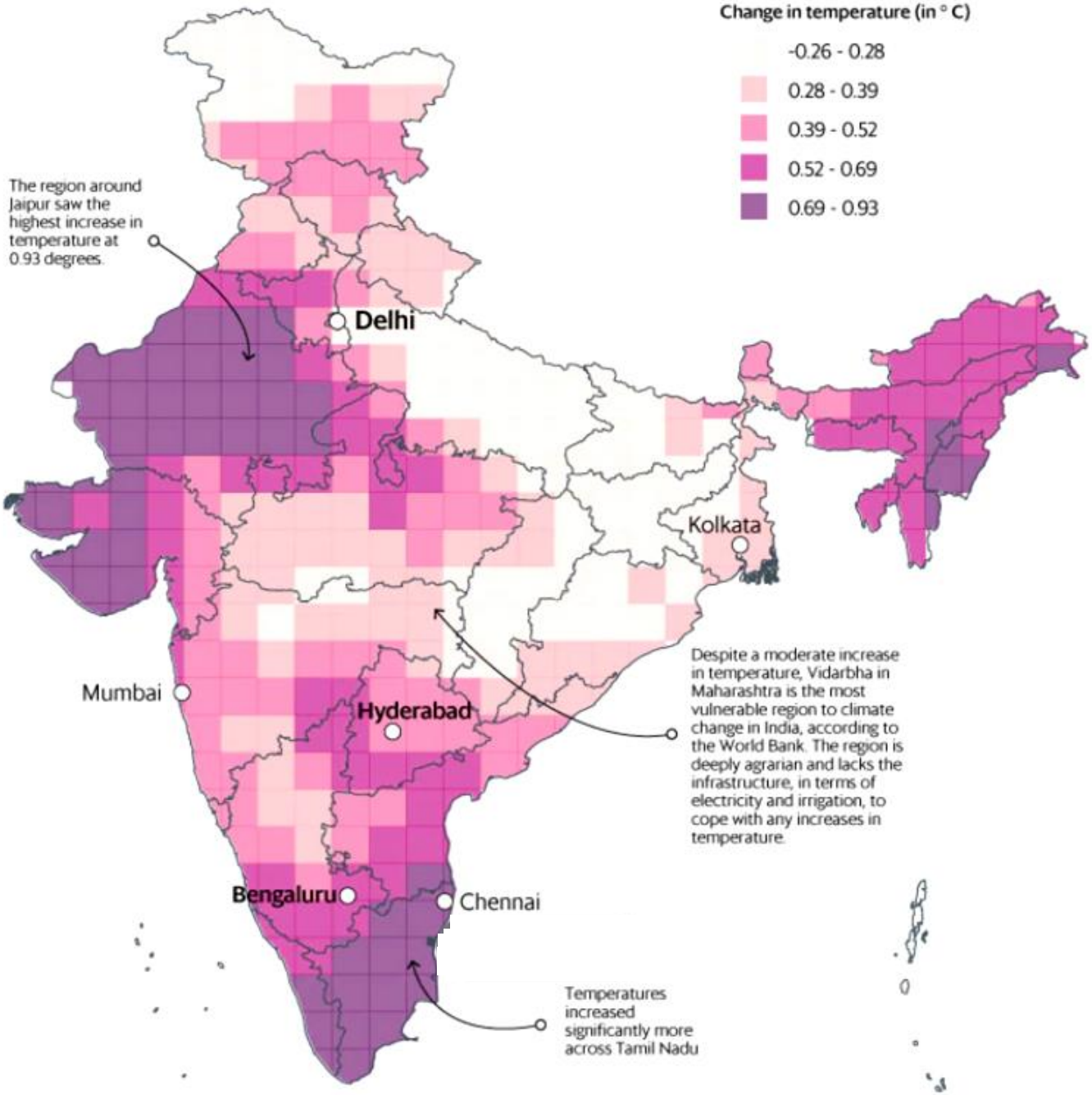


10 of the hottest years on record were in the last 15 years

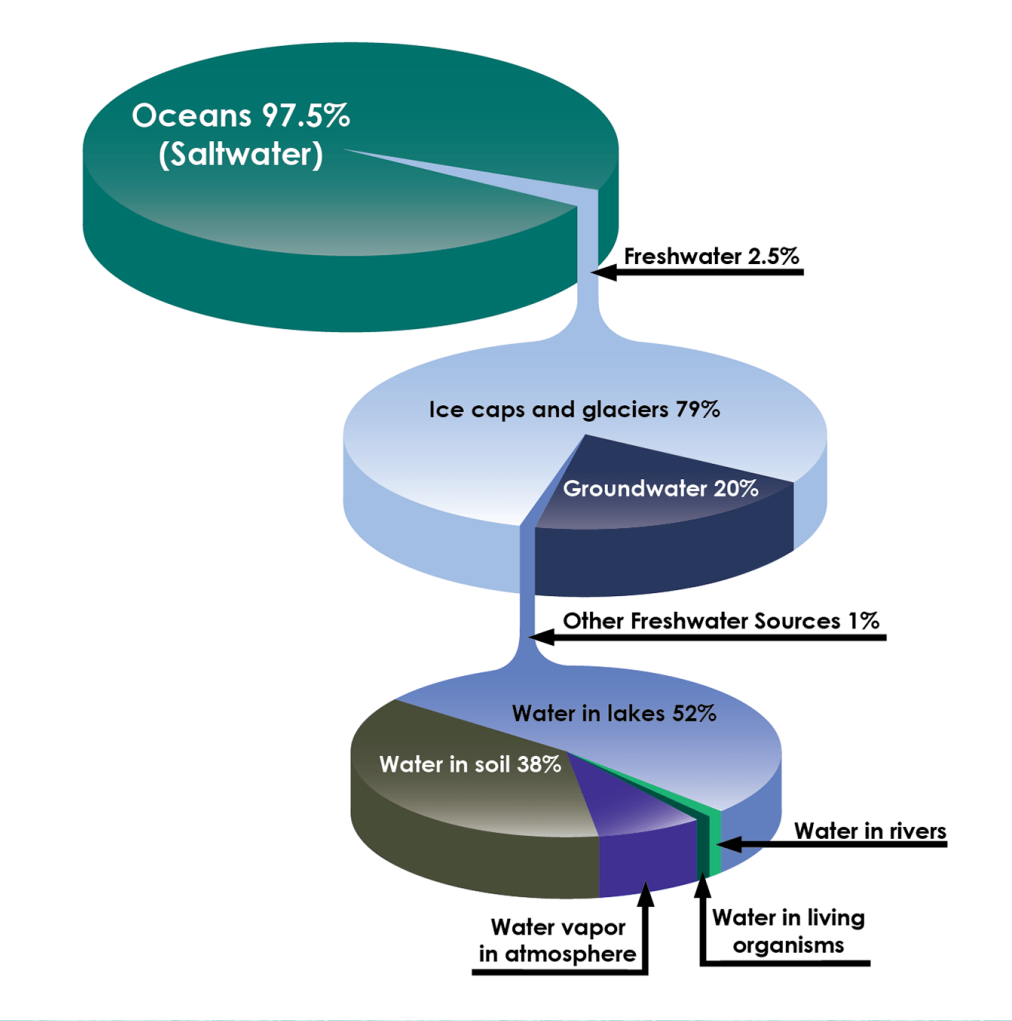
Warmest decades are in the most recent times



Changes in temperature in last decade (2010 – 2018)



Water Resource



Rainfall

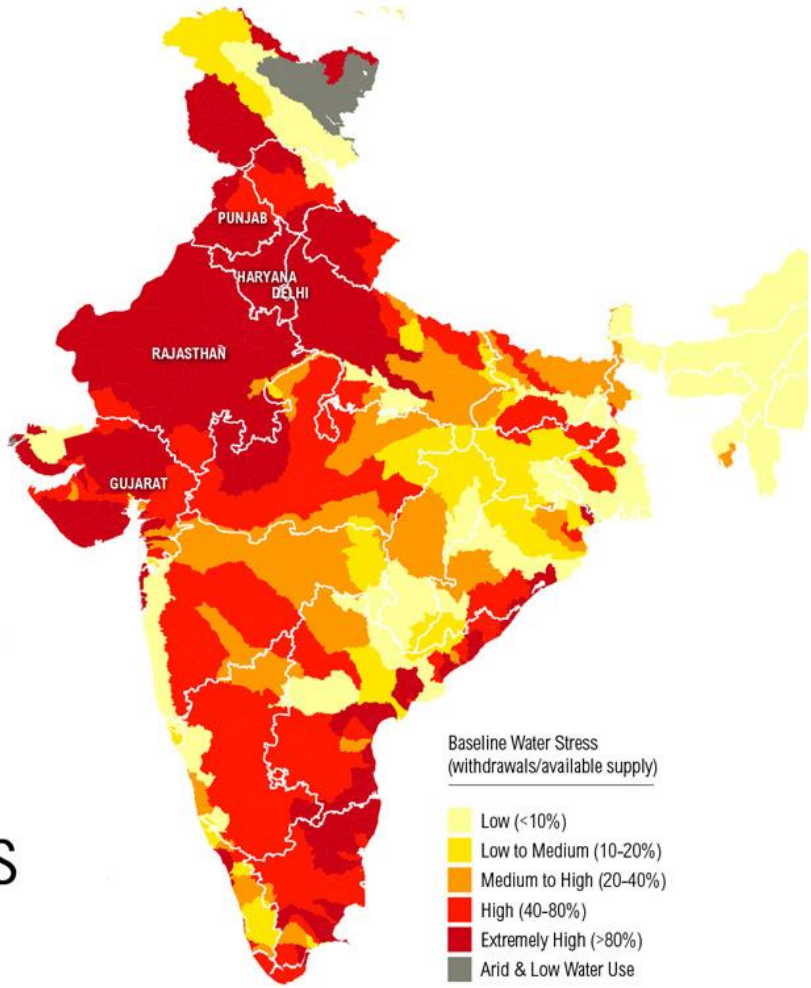
Annual Rainfall of India: 600 mm

Annual Rainfall of Puducherry: 1200 mm

1.5 billion people live in the catchment areas of the Ganga, Brahmaputra and the Indus depend on glacier-melt for water for drinking and irrigation purposes.

54%

of India Faces **High** to **Extremely High** Water Stress



600 million people face high-to-extreme water stress.

75% of households do not have drinking water on premise. **84%** rural households do not have piped water access.

70% of our water is contaminated; India is currently ranked 120 among 122 countries in the water quality index.

The Water Consumer

Irrigation **85.3%**

Industry **1.3%**

Energy **0.3%**

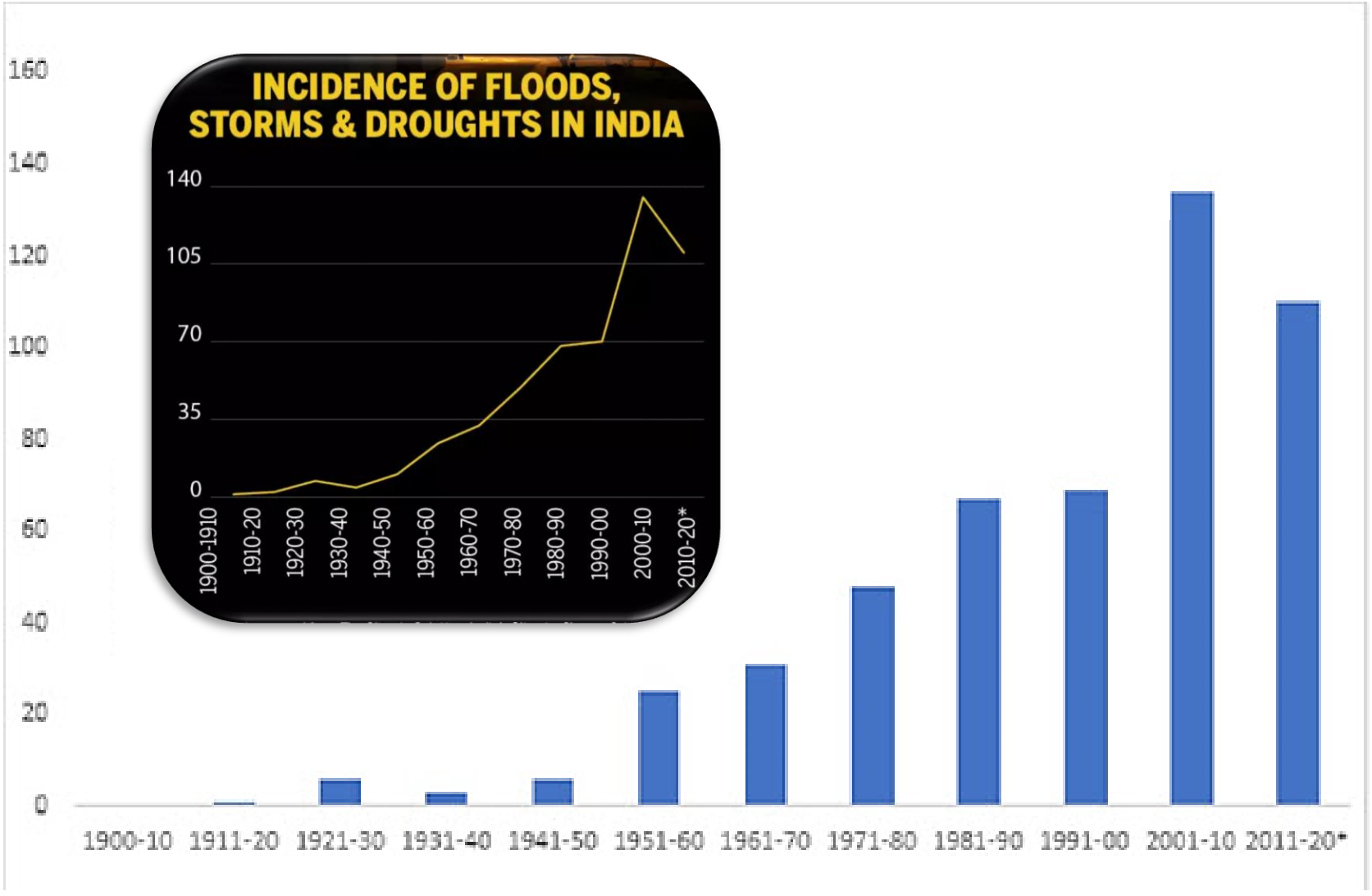
Other **6.5 %**

Domestic **6.6%**

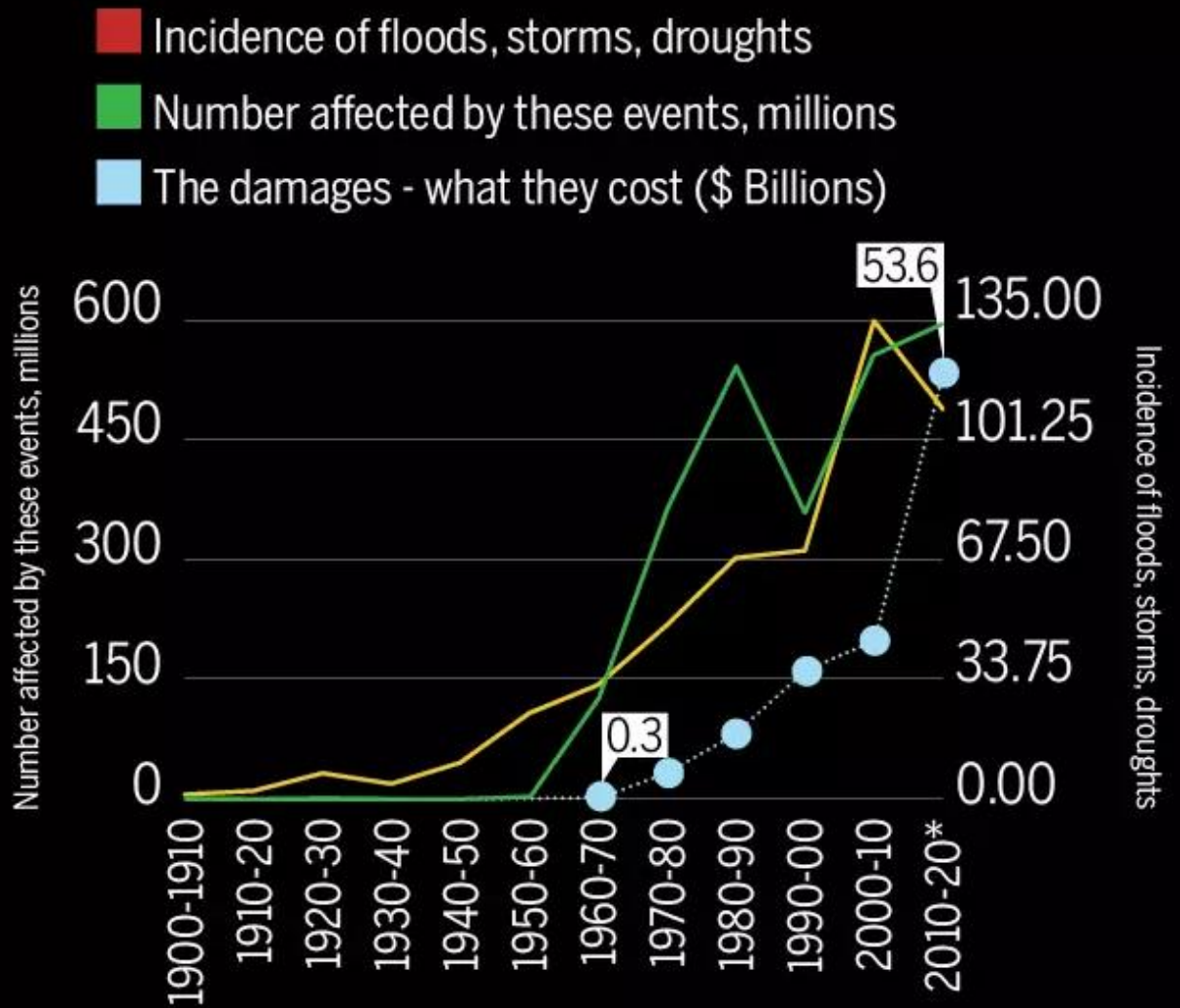
Rainfall based agriculture problems due to Climate Change

- Increased frequency, severity of droughts.
- Increased irrigation water demands due to increasing temperature.
- Salination of ground water due to coastal ingress.
- Direct flood damage to crops.

Decadal Storms, Floods and Droughts in India in the last century

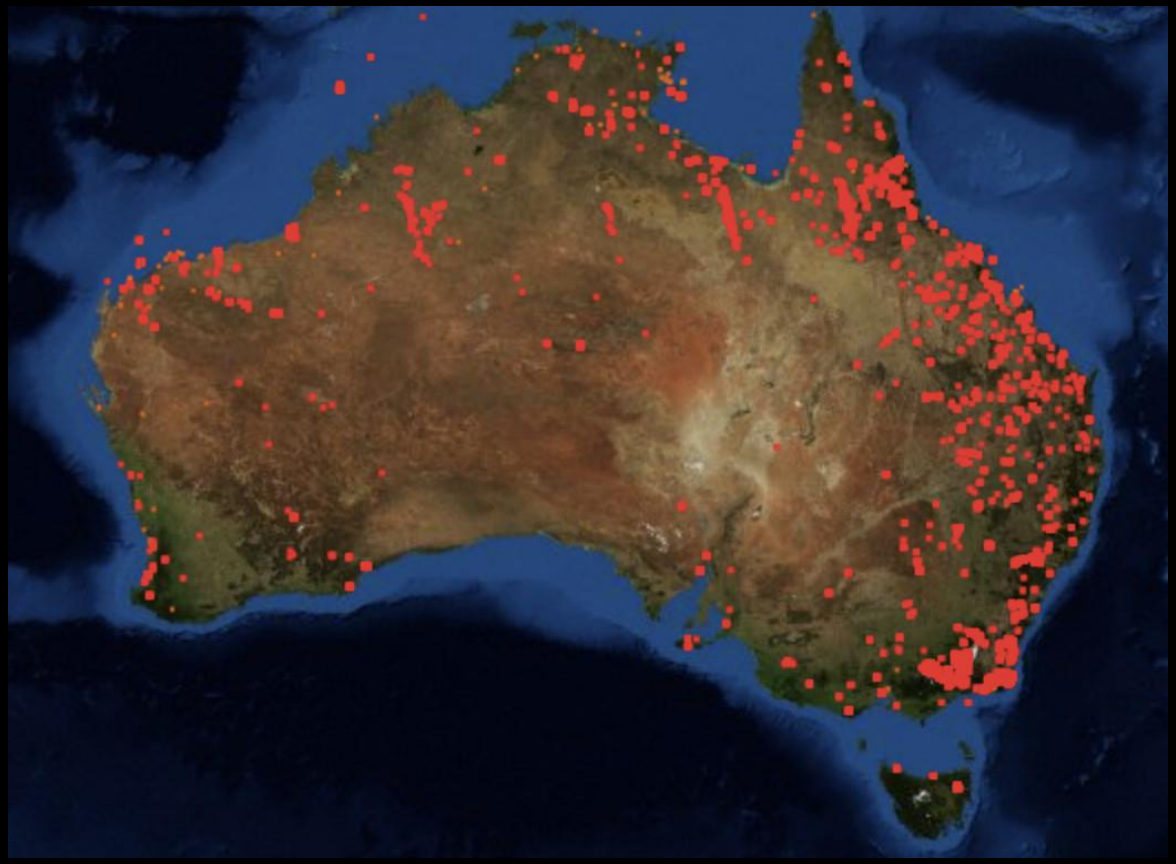


The Cost of Climate Disaster

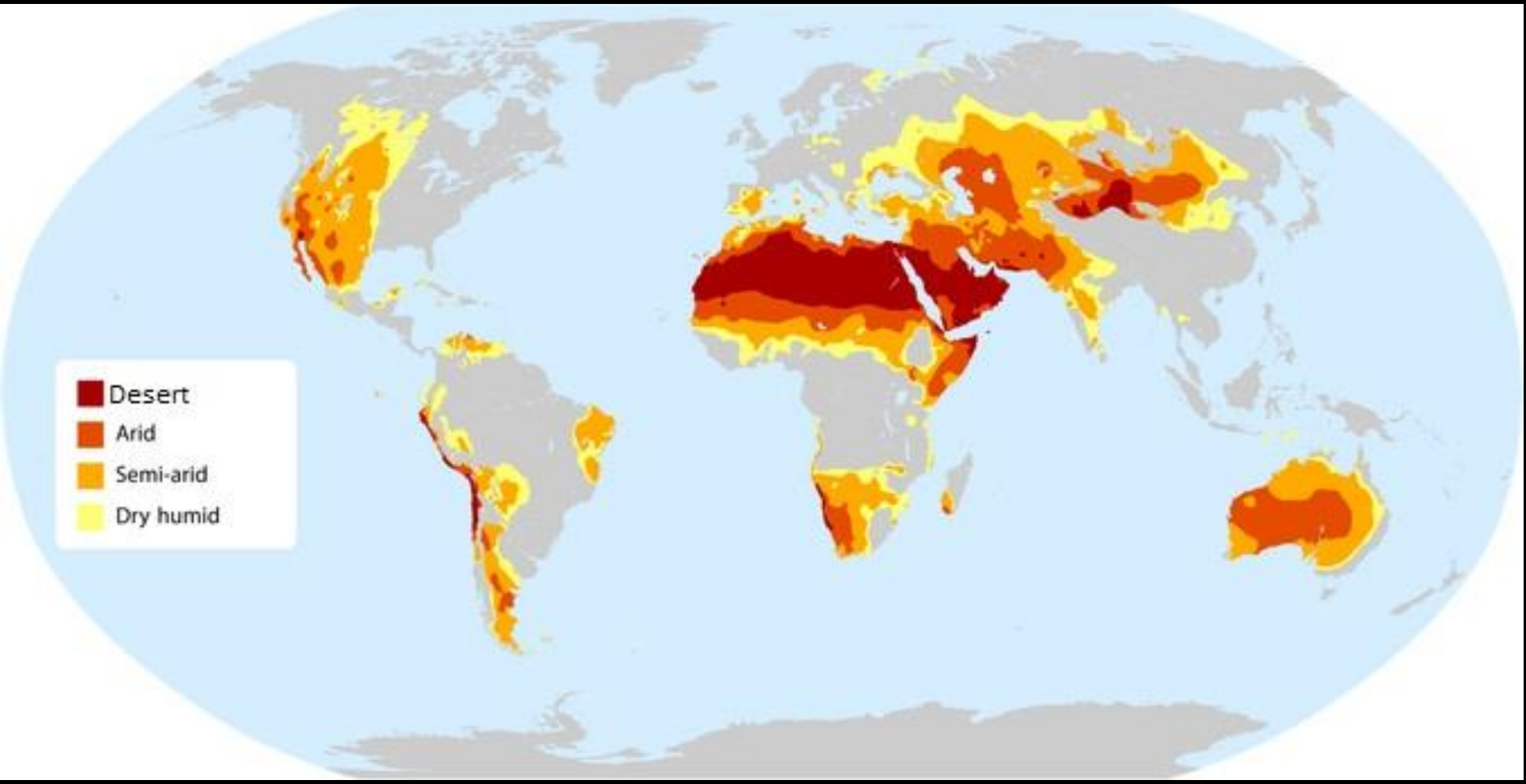


Wildfires

Australian Bushfire



Desertification


Desert
Arid
Semi-arid
Dry humid

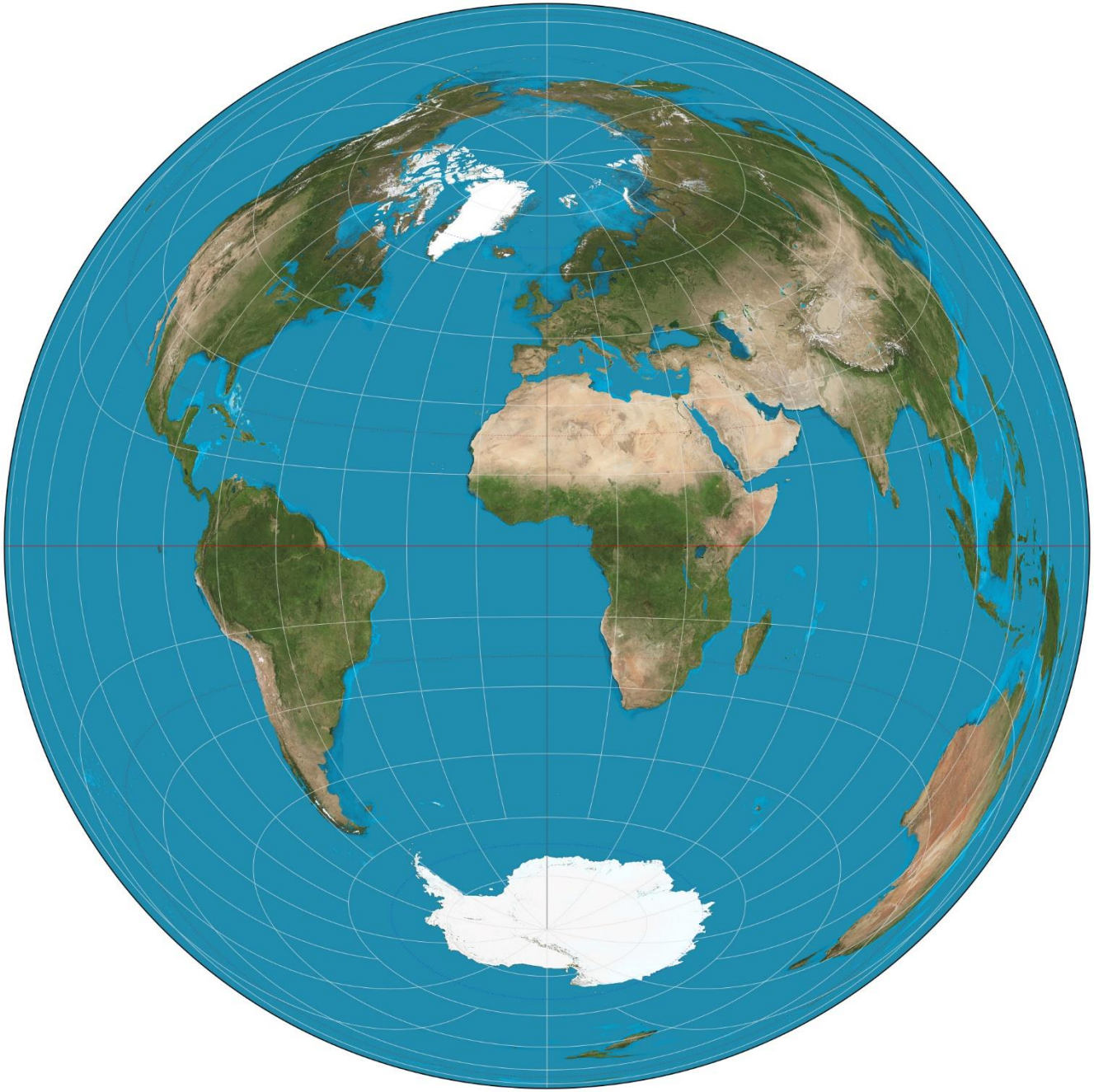
Quick Facts on the World's Drylands

- Drylands Cover 41 percent of the earth's surface.
- Inhabited by **30% of the world's population** (2.5 billion)
- Grow **44%** of the world's **food**.
- Support **50%** of the world's livestock.
- Account for the majority of the world's poor.
- Drought has affected 330 million people in India this year.

Sahel region, Africa

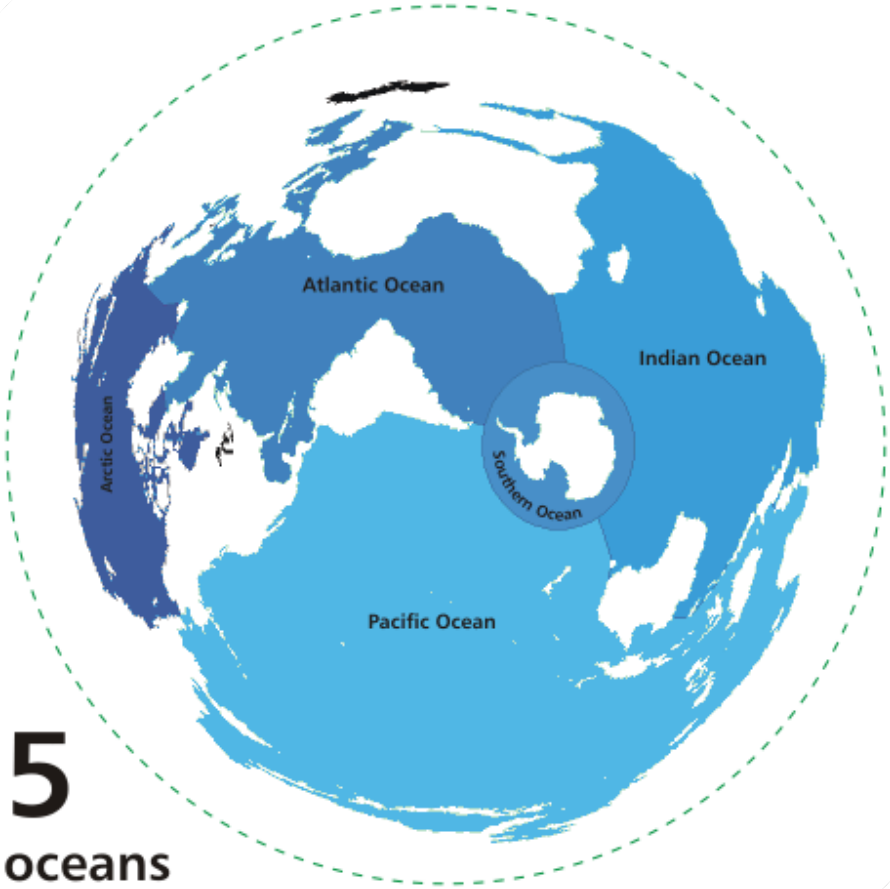
Desertification in India

- 96 million hectares (**29%) of India's area** is under degradation.
- India has **lost 31% of grassland** area in a decade.
- India has witnessed an increase in the level of desertification in 26 of 29 states between 2003-05 and 2011-13.
- More than **80%** of the country's **degraded land** lies in just **nine states**.



Carbon in Ice

THE OCEANS


Atlantic Ocean
Indian Ocean
Arctic Ocean
Southern Ocean
Pacific Ocean
5
oceans

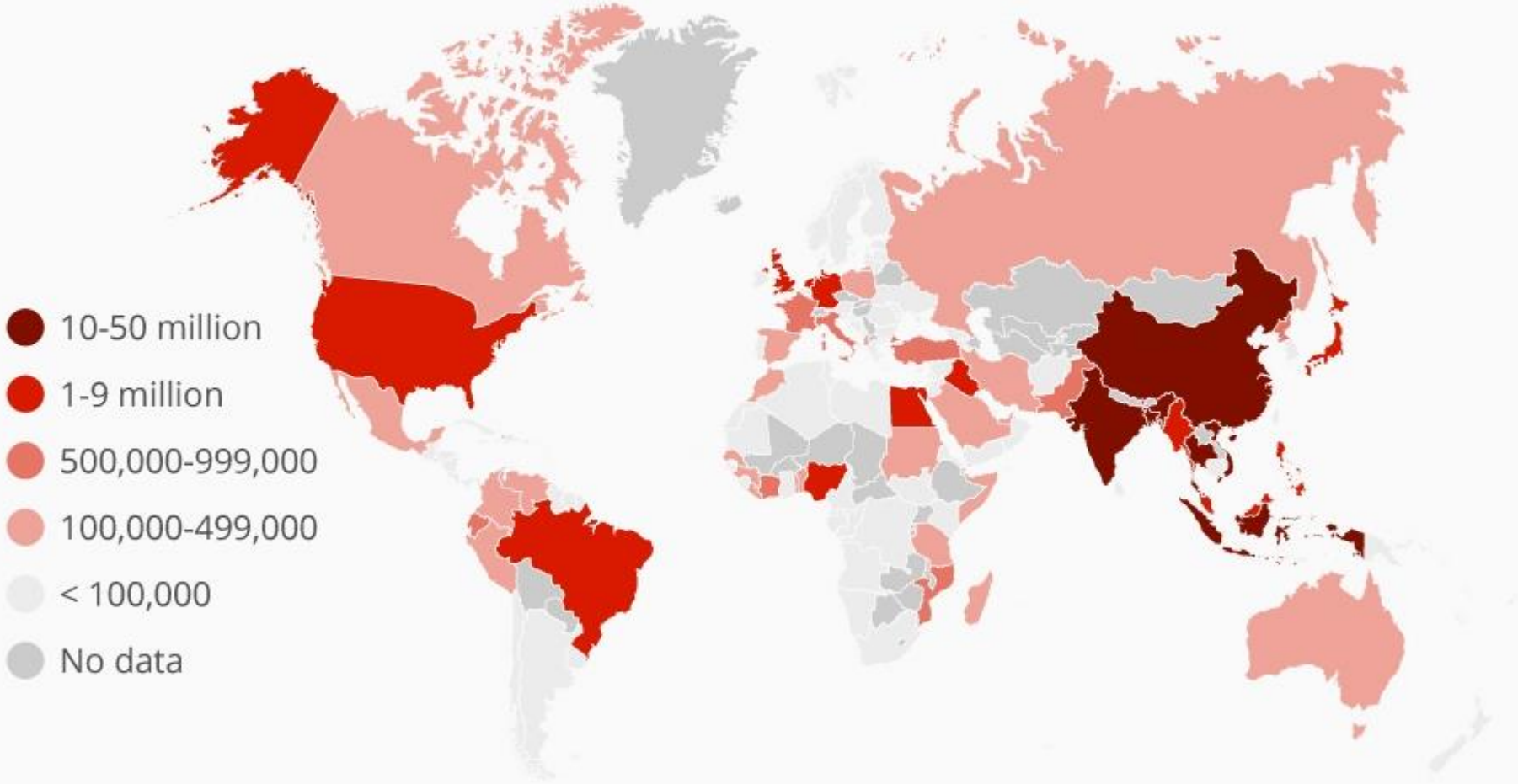
Sea Level Rise by Century

Central reconstruction shown. Bars +/- 2 inches before 20th century
Source: Kopp et al. 2016 (PNAS)

CLIMATE CENTRAL

Where Most People Are Affected by Rising Sea Levels

Number of people per country living on land expected to be under sea level by 2100*



* assuming a rise in sea levels of 50-70 cm (2° C temperature increase/not taking into account ice sheet instability)

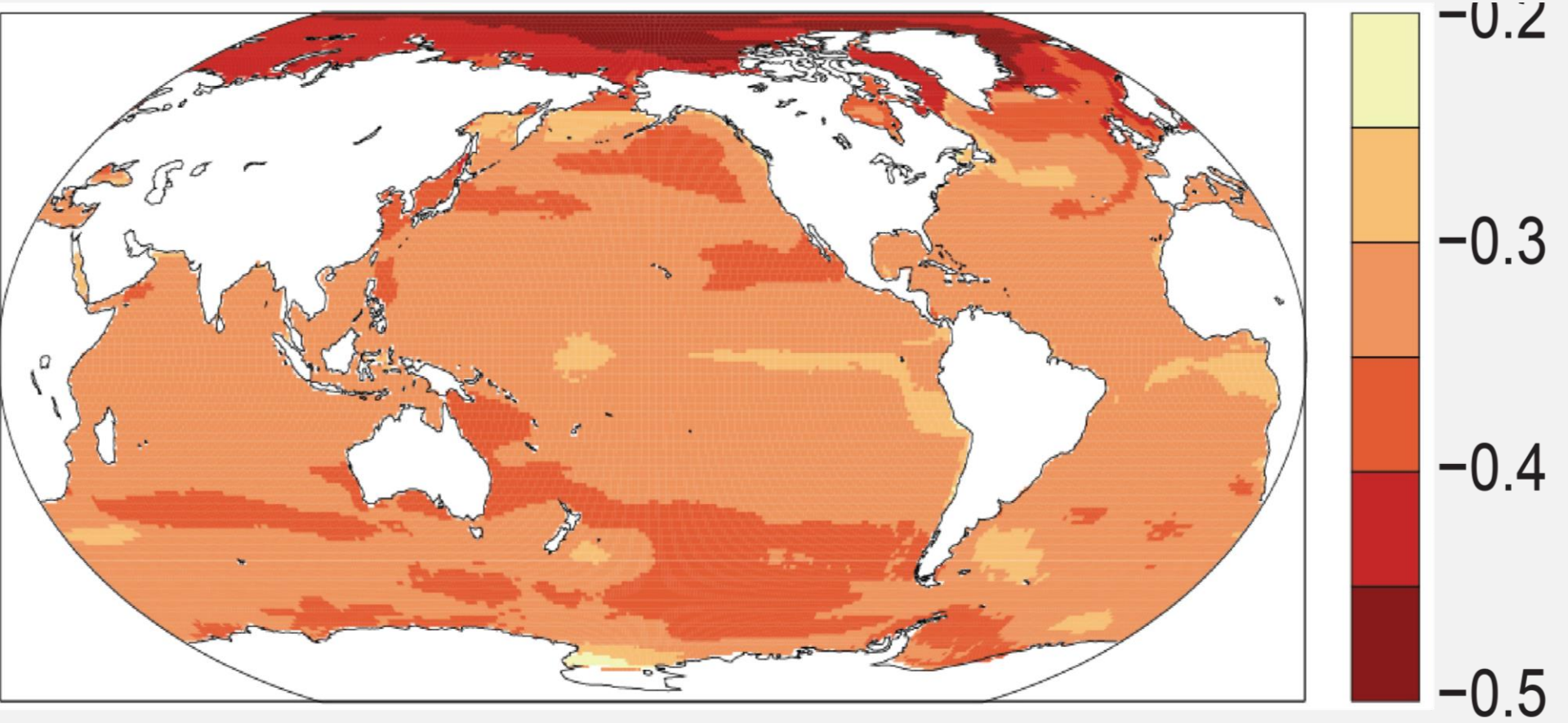
Source: Scott A. Kulp & Benjamin H. Strauss: New elevation data triple estimates of global vulnerability to sea-level rise and coastal flooding, Nature Communications

Ocean Acidification

- Ocean acidification refers to decreasing levels of pH in the ocean, which makes the sea more acidic.

- It is the long-term change in seawater chemistry due to the absorption of carbon dioxide from the atmosphere.

Impacts of Ocean Acidification



Impacts of Ocean Acidification

- Since the beginning of the Industrial Revolution, the pH of surface ocean waters has fallen by **0.1 pH**.

- This change represents about a 30% increase in acidity. Ocean acidification levels are projected to grow 144% by 2100.

- Even if CO_2 emissions were drastically and immediately cut, the effects of ocean acidification and climate change have legacy effects in the ocean for thousands of years.

Change for Climate Change

Paris Agreement: Post 2020 Framework

- **Objective:** To limit temp rise to 2^{o}C and make efforts towards 1.5^{0}C
- **Equity:** CBDR-RC
- **NDC:** All countries to submit Nationally Determined Contributions
- **Market Mechanism:** Provides scope for market based measures.
- **Finance & Technology:** Developed countries obliged to provide finance and technology to developing countries.
- **Transparency:** Framework to track both action and support of countries
- **Global Stocktaking :** To assess collective progress in line with objectives. First stocktaking in 2023; every 5 years thereafter.

- UN launched the 2030 agenda on Sustainable Development Goals to bring sustainable development in the mainstream.
- To build a more sustainable world over the next 15 years.

- There are 17 goals and 169 targets specific targets to be achieved by 2030.

- Reaching the goals requires action on all fronts – governments, businesses, civil society and people everywhere all have a role to play.


SUSTAINABLE DEVELOPMENT GOALS
1 NO POVERTY
2 ZERO HUNGER
3 GOOD HEALTH AND WELL-BEING
4 QUALITY EDUCATION
5 GENDER EQUALITY
6 CLEAN WATER AND SANITATION
7 AFFORDABLE AND CLEAN ENERGY
8 DECENT WORK AND ECONOMIC GROWTH
9 INDUSTRY, INNOVATION AND INFRASTRUCTURE
10 REDUCED INEQUALITIES
11 SUSTAINABLE CITIES AND COMMUNITIES
12 RESPONSIBLE CONSUMPTION AND PRODUCTION
13 CLIMATE ACTION
14 LIFE BELOW WATER
15 LIFE ON LAND
16 PEACE, JUSTICE AND STRONG INSTITUTIONS
17 PARTNERSHIPS FOR THE GOALS
SUSTAINABLE DEVELOPMENT GOALS

India's Nationally Determined Contribution(2015)

1. To propagate a healthy and sustainable way of living.
2. To adopt a climate friendly & cleaner path.
3. To reduce emissions intensity of its GDP by 33 to 35 percent by 2030 from 2005 level.
4. To achieve about 40 percent cumulative electric power installed capacity from non-fossil fuel based energy resources by 2030.
5. To create an additional carbon sink of 2.5 to 3 billion tonnes of CO_2 equivalent through additional forest and tree cover by 2030.
6. To enhance investments in development programmes in sectors vulnerable to climate change.
7. To mobilize domestic and new & additional funds from developed countries.
8. To build capacities, create domestic framework and international architecture for quick transfer of climate technology.

States/UTs	SDG 1	SDG 2	SDG 3	SDG 4	SDG 5	SDG 6	SDG 7	SDG 8	SDG 9	SDG 10	SDG 11	SDG 12	SDG 13	SDG 15	SDG 16	Composite SDG
	Index Score															
Andhra Pradesh	69	35	76	52	37	96	86	78	66	68	36	57	70	86	86	67
Arunachal Pradesh	34	66	50	58	33	88	74	52	31	38	43	67	31	71	62	53
Assam	48	39	44	44	33	78	70	62	46	67	40	68	47	90	52	55
Bihar	33	26	44	19	40	81	62	64	47	74	50	47	43	54	64	50
Chhattisgarh	49	27	52	52	43	92	56	67	38	60	49	58	29	97	71	56
Goa	53	76	60	71	46	77	95	71	45	19	79	63	41	99	79	65
Gujarat	47	39	67	47	36	92	75	75	88	59	77	33	63	77	86	64
Haryana	47	43	65	68	36	81	77	71	73	54	49	39	34	40	76	57
Himachal Pradesh	60	44	67	81	52	82	64	76	70	78	79	52	61	92	84	69
Jharkhand	28	22	55	42	34	78	50	70	70	64	57	36	27	99	67	53
Karnataka	49	37	72	67	42	88	86	78	40	70	48	72	71	89	75	66
Kerala	64	74	82	74	51	77	70	61	88	75	51	57	56	98	77	70
Madhya Pradesh	40	24	50	54	45	92	62	67	44	68	55	58	47	94	63	58
Maharashtra	47	34	76	65	41	93	82	70	59	70	45	71	50	85	72	64
Manipur	42	69	62	70	34	87	72	27	43	81	28	85	37	100	70	60
Meghalaya	68	35	53	55	34	70	52	65	22	76	22	60	36	99	59	54
Mizoram	67	75	52	61	37	81	81	42	8	66	33	50	45	75	63	56
Nagaland	56	70	29	47	42	75	70	28	23	61	23	100	51	94	84	57
Odisha	47	34	61	40	35	85	50	59	72	69	51	44	69	99	61	58
Punjab	48	61	71	67	46	74	89	65	69	50	61	35	57	59	83	62
Rajasthan	56	35	58	51	39	76	61	65	38	70	61	30	60	75	76	57
Sikkim	65	66	59	58	49	79	97	68	27	64	74	60	38	100	69	65
Tamil Nadu	72	48	76	70	40	90	90	74	53	65	51	63	45	91	78	67
Telangana	52	36	66	64	26	84	93	82	61	94	62	58	66	88	77	67
Tripura	70	49	61	55	32	69	56	63	48	45	31	92	37	88	73	58
Uttar Pradesh	40	31	34	48	41	94	63	64	63	46	56	62	48	62	69	55
Uttarakhand	64	45	58	66	38	90	78	73	55	59	51	50	59	95	85	64
West Bengal	52	40	70	50	38	83	58	72	68	73	34	57	37	88	73	60
A and N Islands	48	38	65	61	48	85	73	55	13	94	47	69	72	85	65	61
Chandigarh	48	73	54	80	47	100	84	64	74	33	83	77	54	93	89	70
D and N Haveli	33	45	57	53	44	91	80	63	100	57	41	65	41	100	80	63
Daman & Diu	58	12	50	43	39	96	81	54	100	80	54	41	46	89	76	61
Delhi	54	56	54	64	27	61	96	60	100	69	63	39	30	82	64	61
Jammu & Kashmir	58	55	62	54	53	85	76	46	49	47	33	61	59	74	69	59
Lakshadweep	56	57	58	62	37	69	43	43	0	93	Null	75	100	100	82	63
Puducherry	56	71	71	67	35	86	97	58	86	92	53	43	39	37	94	66
India	50	35	61	58	42	88	70	64	65	64	53	55	60	66	72	60
Target	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100

Aspirant (0-49) Performer (50-64) Front Runner (65-99) Achiever (100)

Puducherry

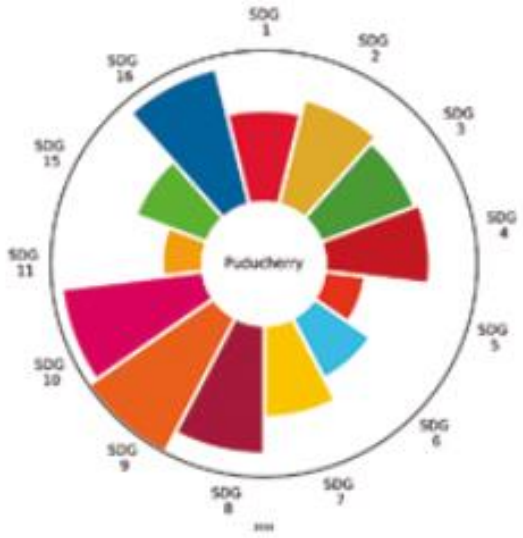
OVERALL PERFORMANCE

60
India Score

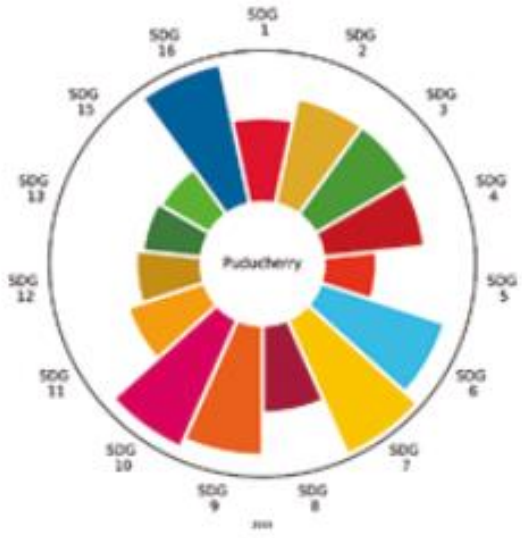
66
Puducherry Score

AVERAGE PERFORMANCE BY SDG

2018



2019



The Alternates… The Future…

Wind Power

Solar Power

Fuel-Efficiency

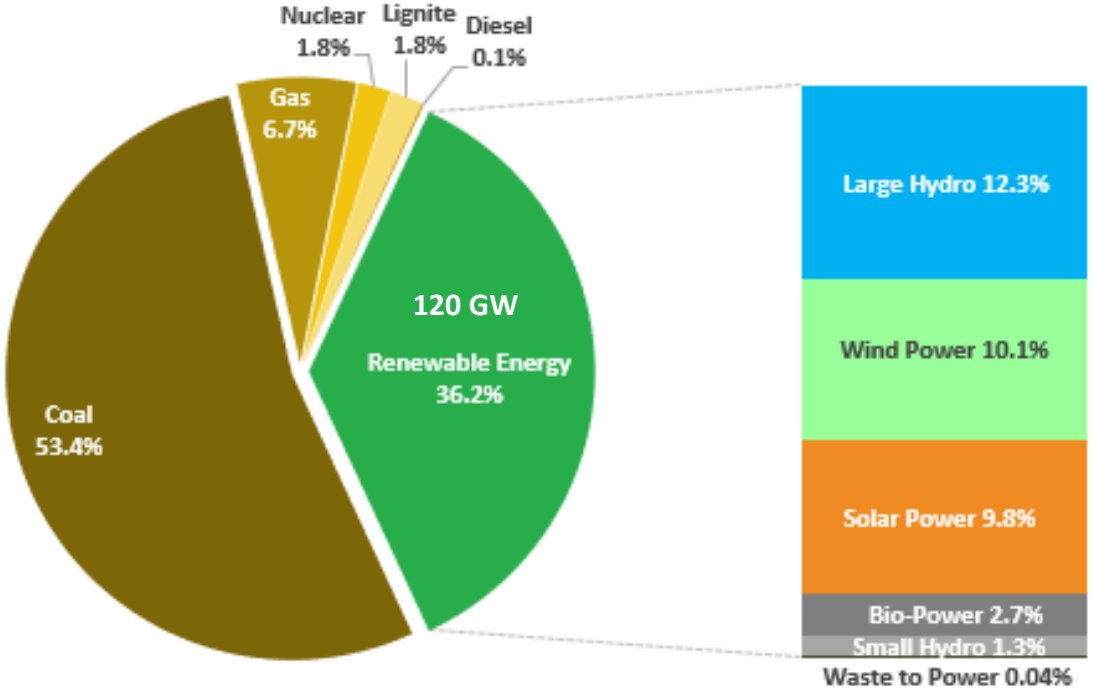
Cost of Solar Power

India's Installed Power Capacity Mix (%)

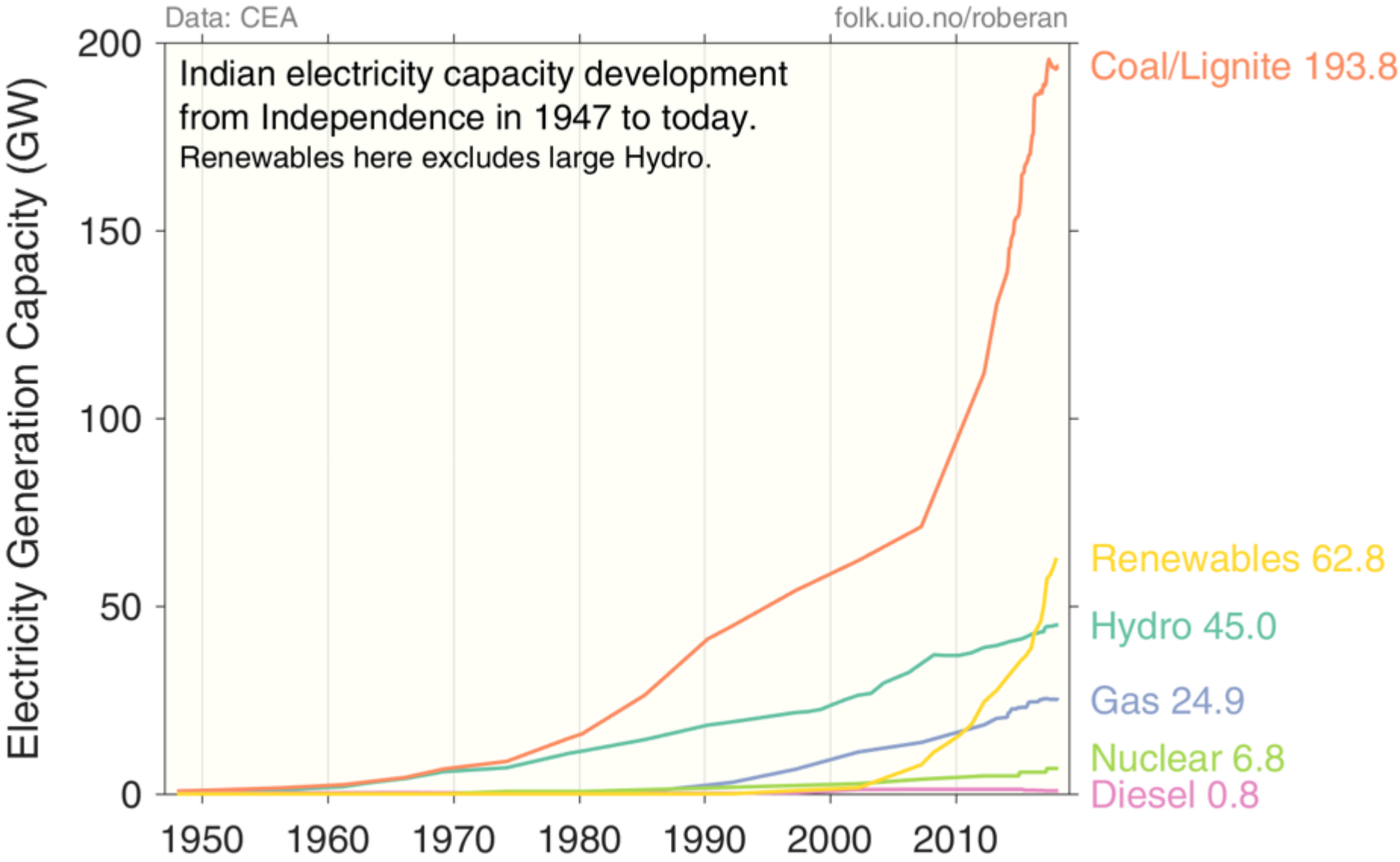
India's installed power capacity: **371 GW** (June 2020)

Puducherry's Power Consumption: 465 MW

Renewables (including Large Hydro) comprise ~36.2% of India's total installed capacity, with solar accounting for ~9.8%. Among renewables, solar accounts for ~27.2% of the installed capacity



Data from CEA, MNRE, Mercom India Solar Project Tracker (Installed Capacity as on 31 Mar 2020) *Source: Mercom India Research*


Data: CEA
folk.uio.no/roberan
Indian electricity capacity development
from Independence in 1947 to today.
Renewables here excludes large Hydro.
Electricity Generation Capacity (GW)
200
150
100
50
0
1950
1960
1970
1980
1990
2000
2010
Coal/Lignite 193.8
Renewables 62.8
Hydro 45.0
Gas 24.9
Nuclear 6.8
Diesel 0.8

Government of Puducherry

Department of Science, Technology and Environment

Puducherry Climate Change Cell

Change for Climate Change

Presented By: Balaji. T

Puducherry Climate Change Cell
DSTE

Thank You!