

Climate change: science, scenarios, solutions

Smita Malpani

Environmental Science

Washtenaw Community College

The Greenhouse Effect

The **greenhouse effect** – the process by which gases in the atmosphere trap heat and warm the Earth



1. About 50% of solar radiation is absorbed by Earth's surface. This comes as short-wave UV and visible radiation. Our atmosphere is practically transparent to incoming solar radiation.

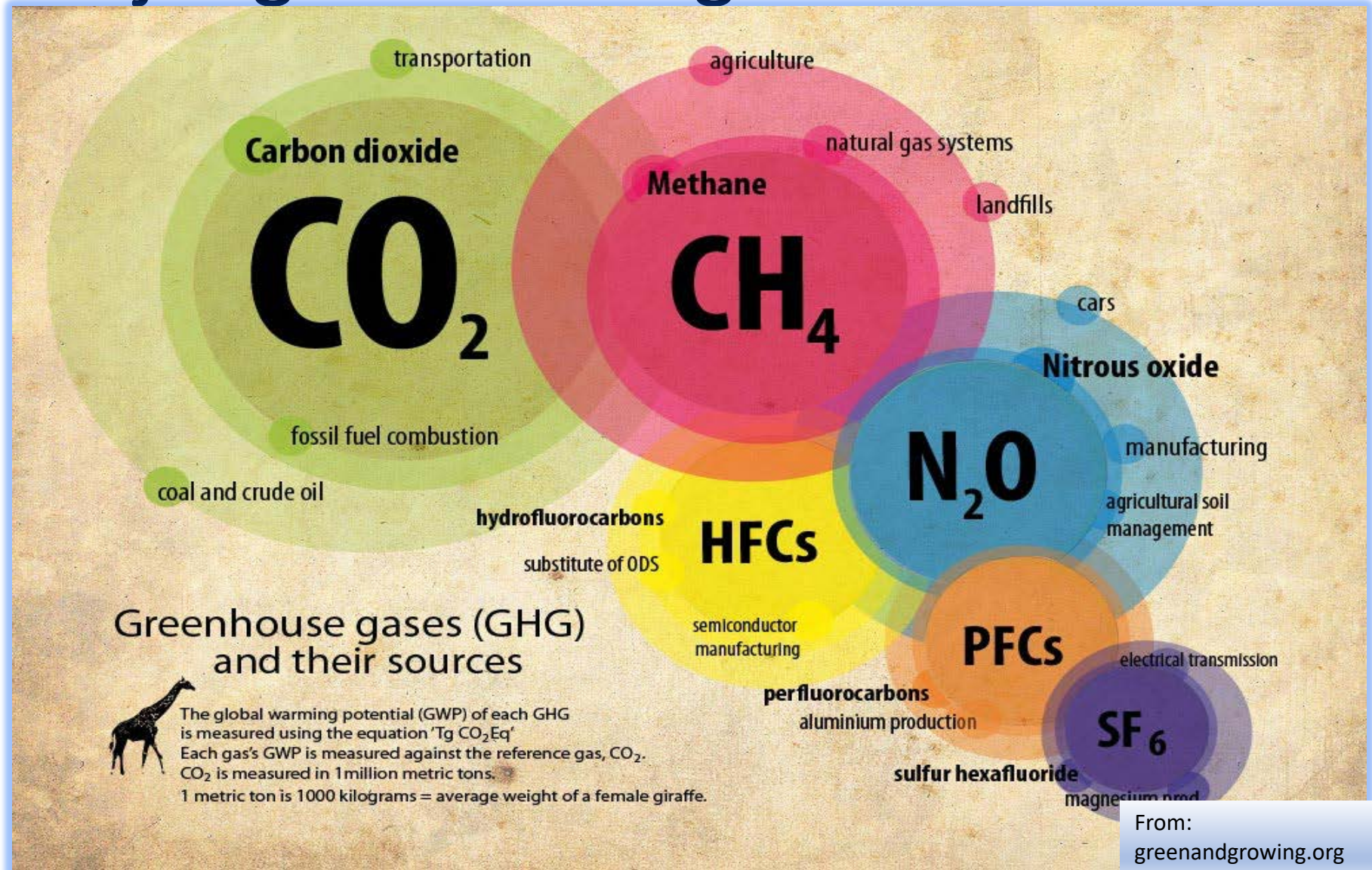
The diagram shows a yellow sun in the top left corner. A thick yellow arrow representing solar radiation points from the sun towards the Earth's surface. The Earth is depicted as a blue and green globe. An orange arrow points upwards from the Earth's surface towards the atmosphere, representing long-wave infrared radiation. A red arrow points downwards from the atmosphere back towards the Earth's surface, representing re-radiation by greenhouse gases.

2. After a short lag time, Earth re-radiates the incoming solar radiation as long-wave infrared radiation.

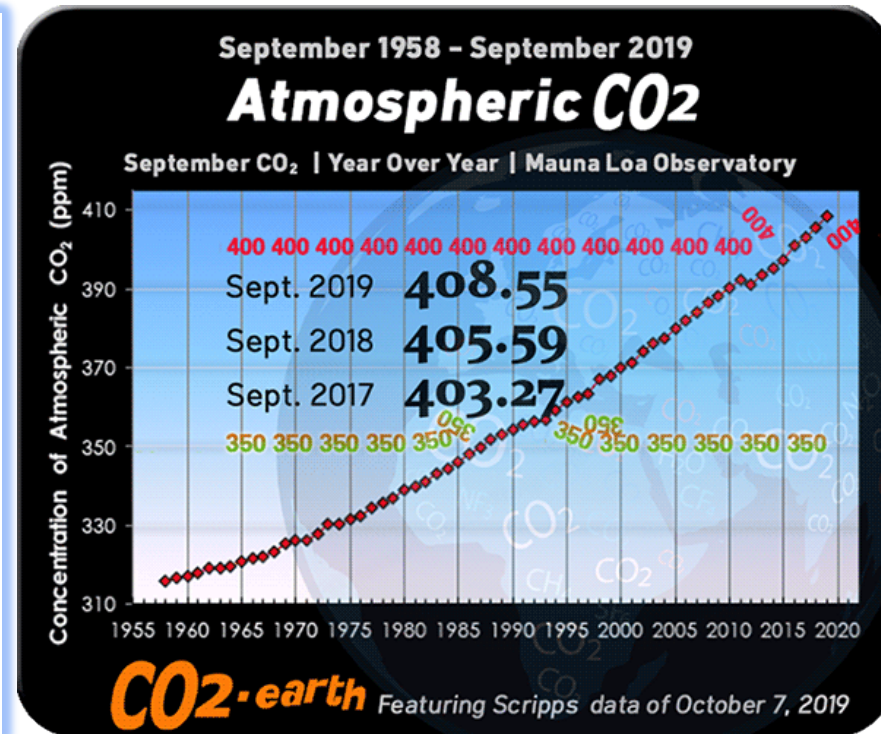
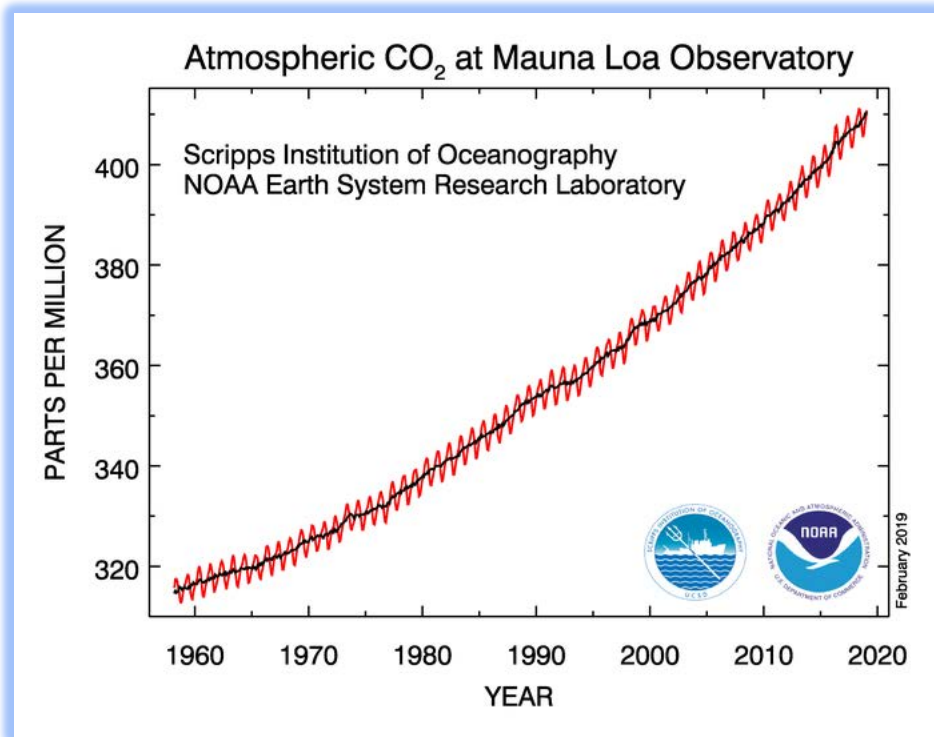
3. Much of this radiation leaves our atmosphere.

4. Greenhouse gases, like methane and CO₂ readily absorb this outgoing radiation and re-radiate it back towards Earth, warming us.

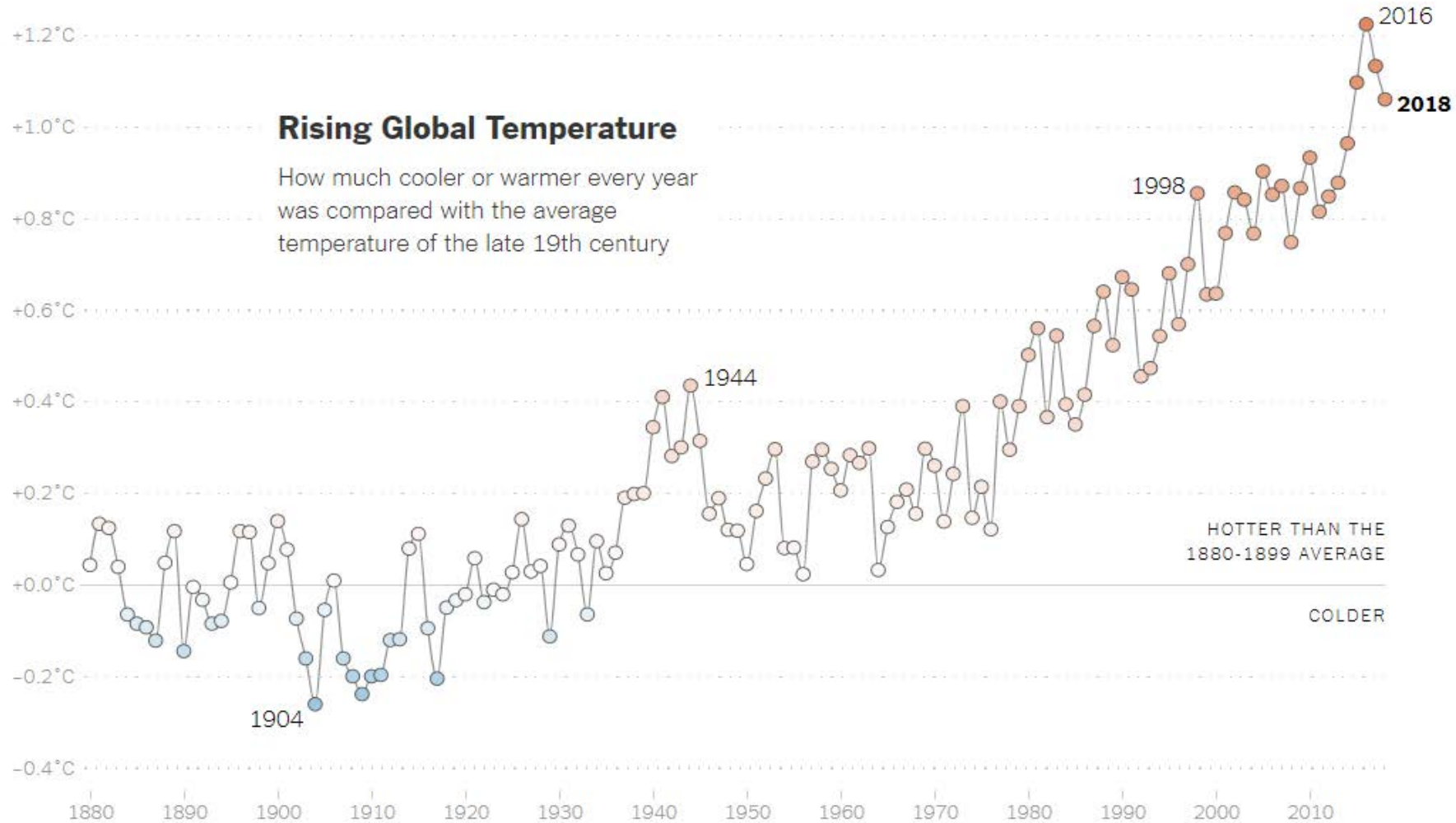
The major greenhouse gases



Atmospheric CO₂ as of Sept. 2019 (May 2019- 415 ppm)



The five last years have been the hottest on record- 18 of the last 19 have been the hottest



INCREASING IMPACTS FROM 1.5°C TO 2°C

POPULATION EXPOSED TO WATER SCARCITY



EXTREME HOT DAYS



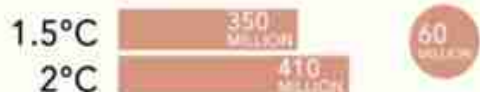
EXTREME COLD NIGHTS



POPULATION EXPOSED TO FLOODS



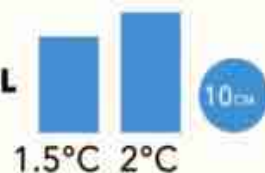
POPULATION EXPOSED TO DROUGHT



POPULATION EXPOSED TO SEA LEVEL RISE WITHOUT ADAPTATION



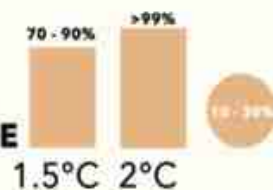
SEA LEVEL RISE



ARCTIC FREE OF SEA ICE IN SUMMER



CORAL DECLINE



LOSS OF HABITAT > 50%



PLANTS



VERTEBRATES

ECOSYSTEM TRANSFORMATION



DECLINE IN FISHERIES



POPULATION EXPOSED TO SEVERE HEAT WAVES



Source: IPCC Special Report on Global Warming of 1.5°C

Tipping Points: Positive Feedback Loops \Rightarrow Abrupt Climate Change

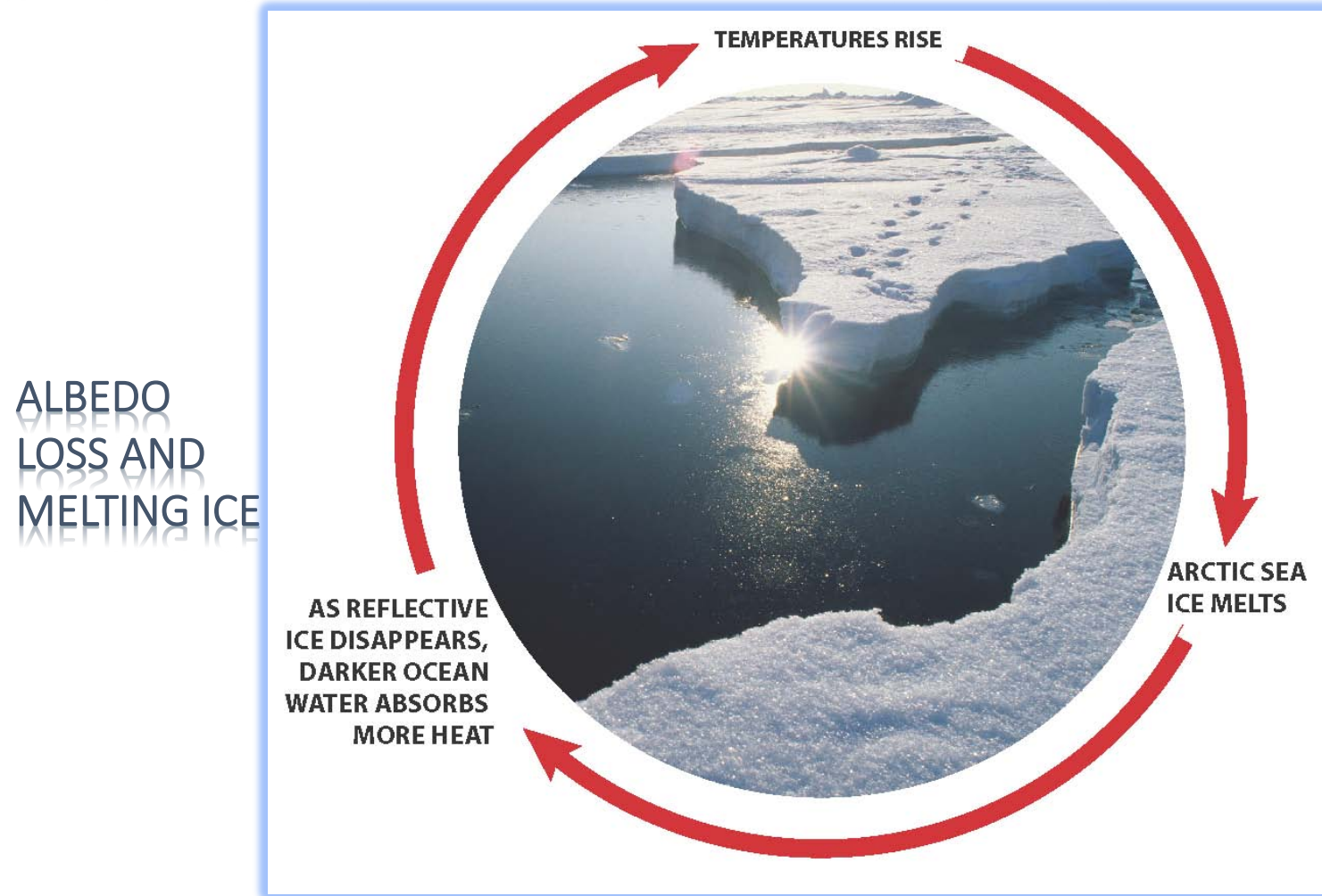
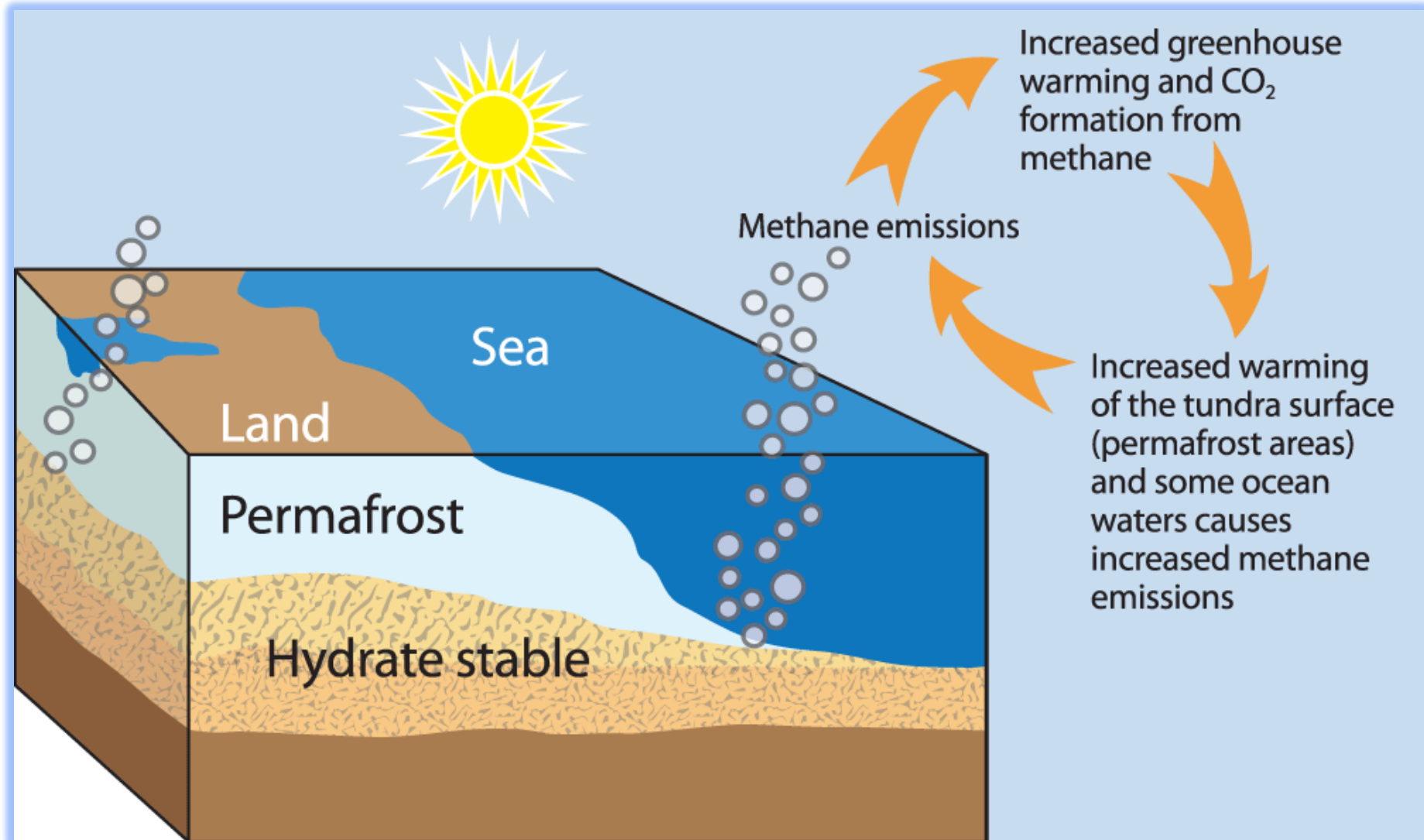


Image Source: National Academies of Sciences

Tipping Points: Positive Feedback Loops —> Abrupt Climate Change



Some impacts of climate change

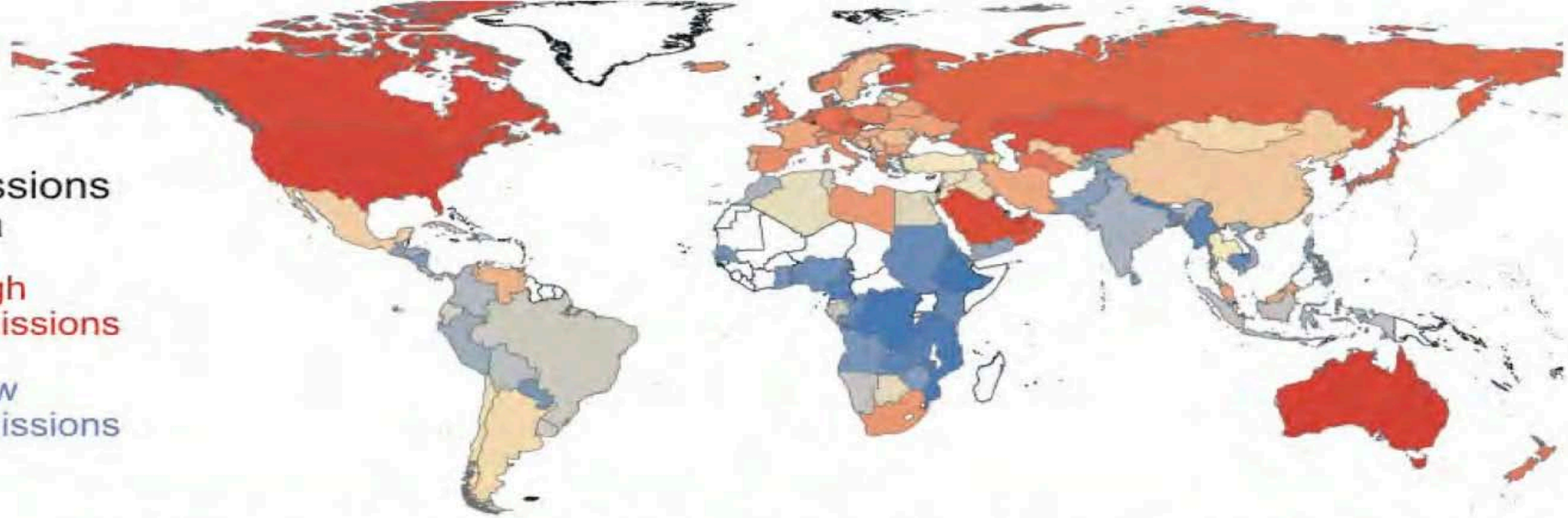
- US economy contracts by 10%
- Sea level rise- 1-2 meters by 2100, and 3-7 m after 2100
- Droughts, food security, malnutrition
- Violence and conflict
- Health impacts of extreme heat and poor air quality
- Impacts on fisheries, biodiversity



Climate Change Solutions- Drawdown

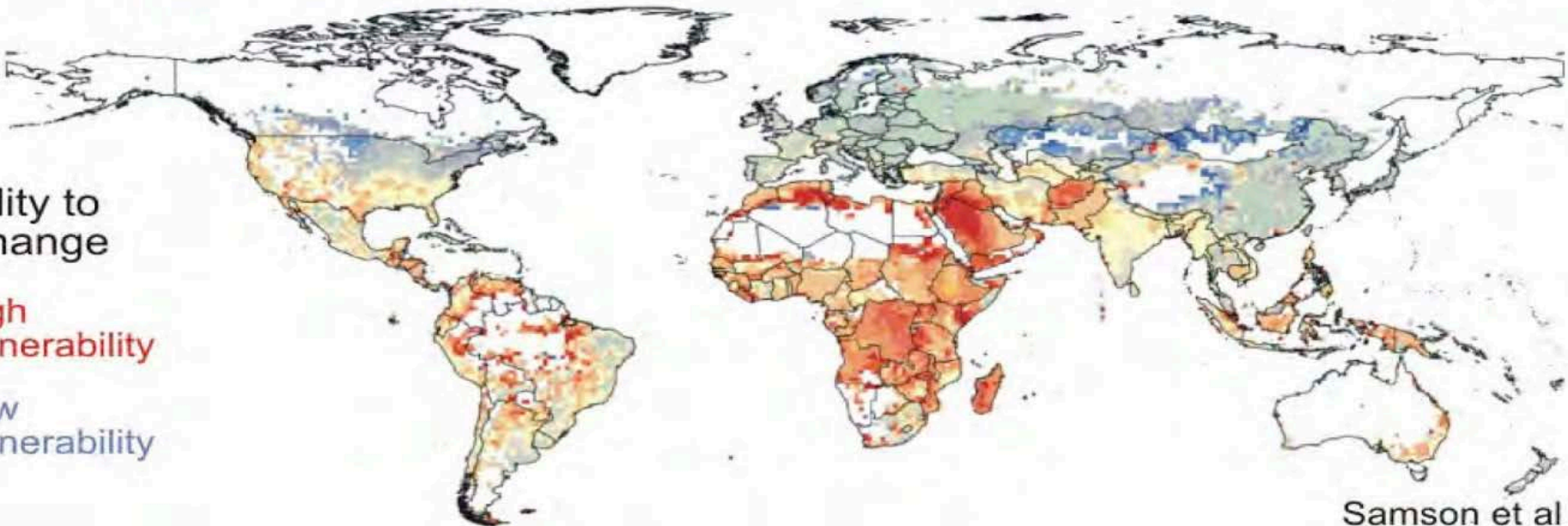
Rank	Solution	Sector	TOTAL ATMOSPHERIC CO2-EQ REDUCTION (GT)	NET COST (BILLIONS US \$)	SAVINGS (BILLIONS US \$)
1	Refrigerant Management	Materials	89.74	N/A	\$-902.77
2	Wind Turbines (Onshore)	Electricity Generation	84.60	\$1,225.37	\$7,425.00
3	Reduced Food Waste	Food	70.53	N/A	N/A
4	Plant-Rich Diet	Food	66.11	N/A	N/A
5	Tropical Forests	Land Use	61.23	N/A	N/A
6	Educating Girls	Women and Girls	59.60	N/A	N/A
7	Family Planning	Women and Girls	59.60	N/A	N/A
8	Solar Farms	Electricity Generation	36.90	\$-80.60	\$5,023.84
9	Silvopasture	Food	31.19	\$41.59	\$699.37
10	Rooftop Solar	Electricity Generation	24.60	\$453.14	\$3,457.63

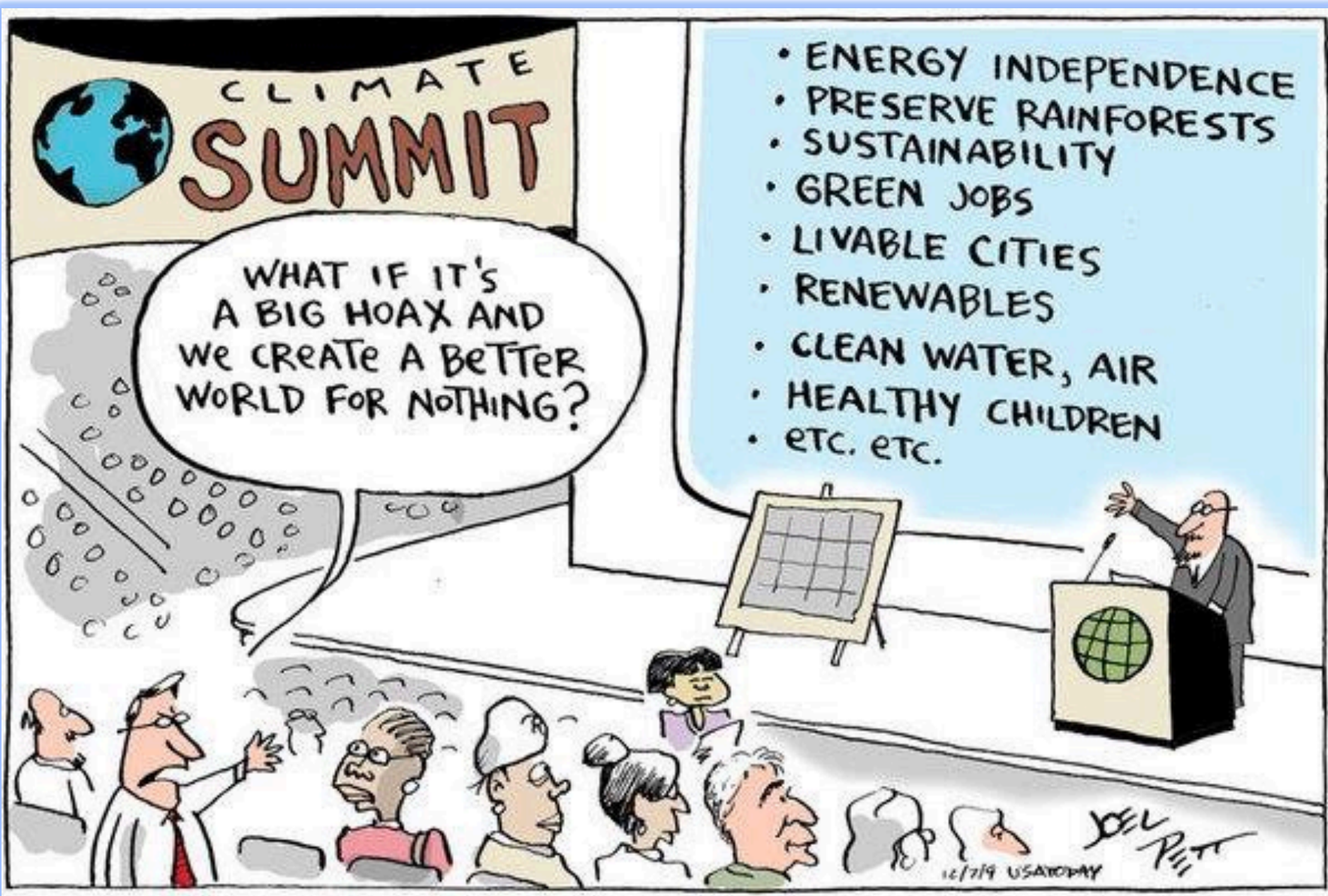
CO2 emissions
per capita



**Those who contribute the least greenhouse gases
will be most impacted by climate change**

Vulnerability to
climate change





WHAT IF IT'S
A BIG HOAX AND
WE CREATE A BETTER
WORLD FOR NOTHING?

- ENERGY INDEPENDENCE
- PRESERVE RAINFORESTS
- SUSTAINABILITY
- GREEN JOBS
- LIVABLE CITIES
- RENEWABLES
- CLEAN WATER, AIR
- HEALTHY CHILDREN
- etc. etc.

12/19 USA TODAY

JOEL PITT