

THE FRAGILE FRAMEWORK

*Can nations unite to save
Earth's climate?*



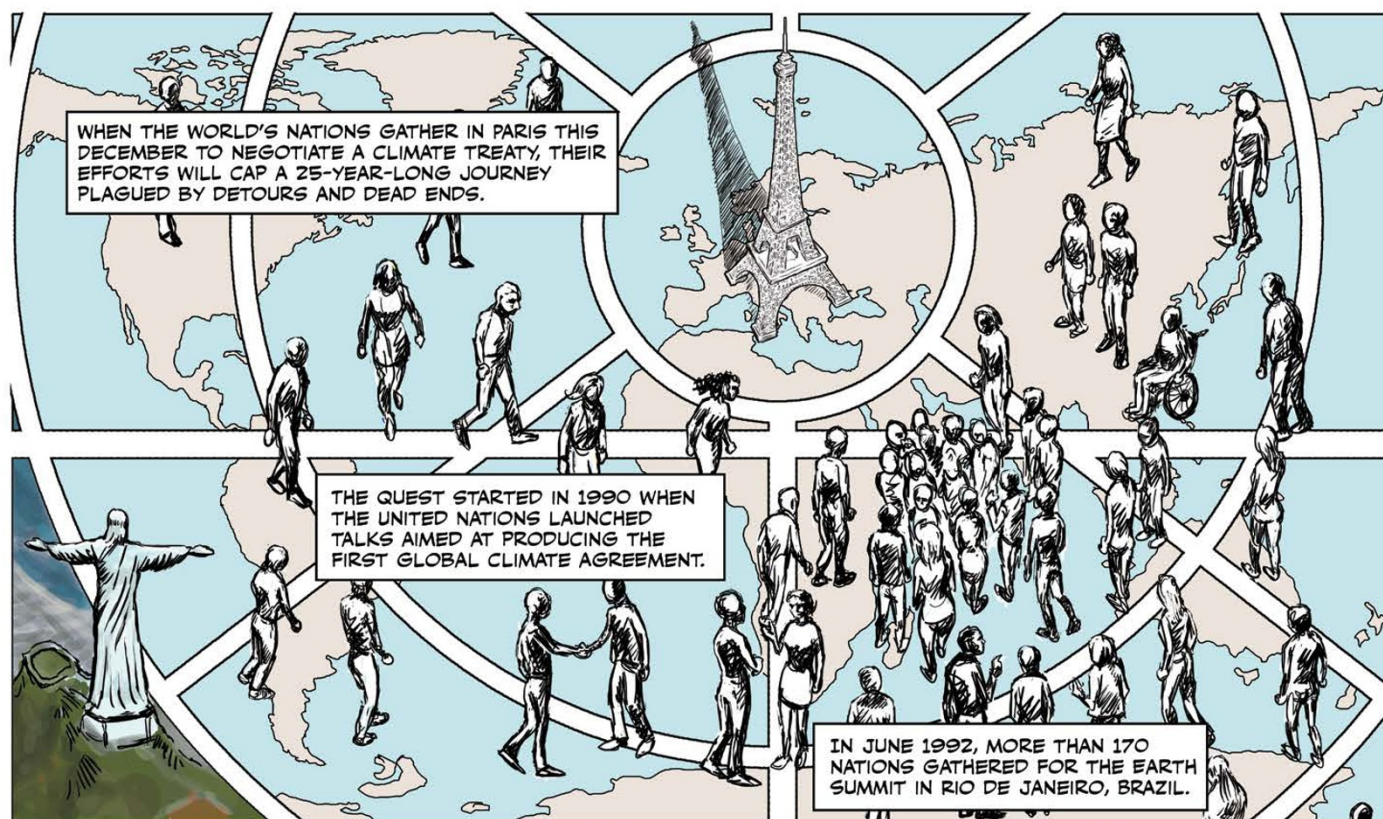
A COMIC BY
**RICHARD MONASTERSKY
AND NICK SOUSANIS**



PARIS CLIMATE TALKS

A *Nature* special issue

nature.com/parisclimate



IN RIO, THEY ADOPTED THE UNITED NATIONS FRAMEWORK CONVENTION ON CLIMATE CHANGE (UNFCCC),



empêche toute perturbation anthropique dangereuse du système climatique

气候系统受到危险的人为干扰

The ultimate objective of this Convention ... is to achieve ... stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system.

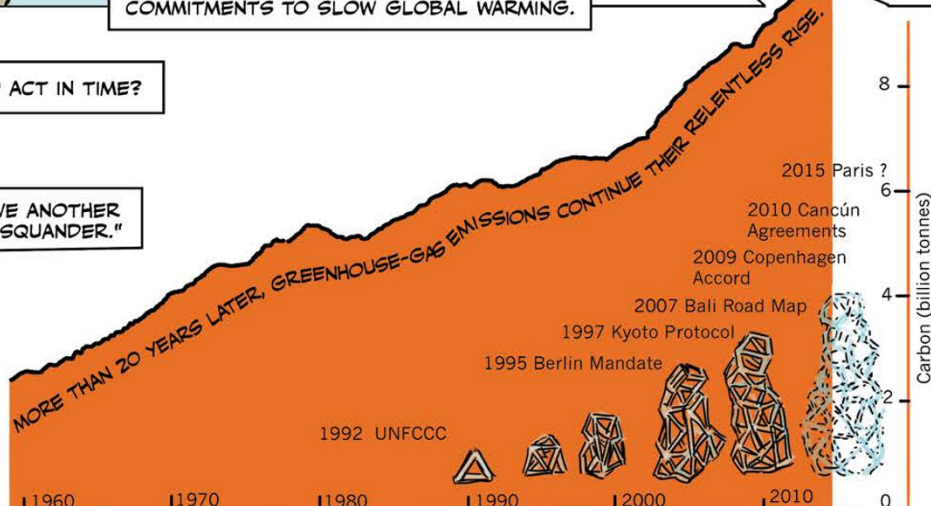
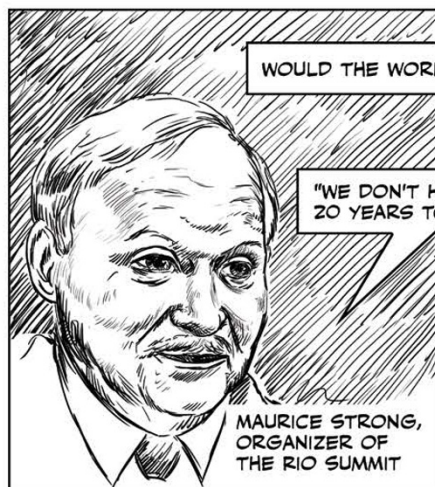
не допускать бы опасного антропогенного воздействия на

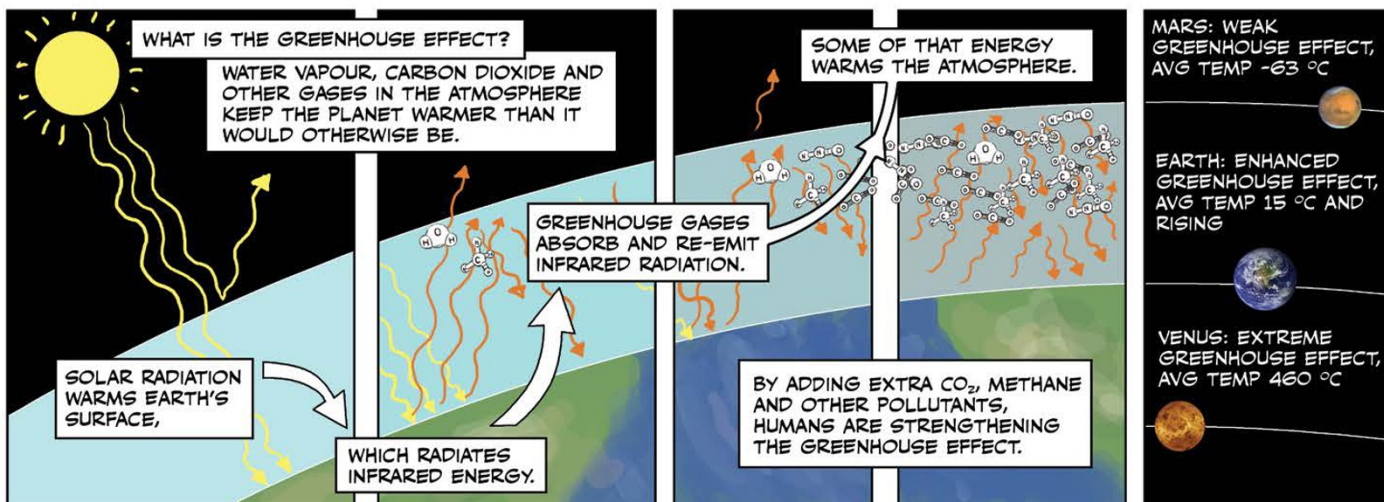
الإنسان جانب من خطر تدخل دون يحول

impida interferencias

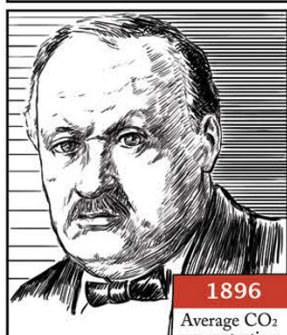
en las peligrosas

THE RIO CONVENTION WAS A HISTORIC STEP, BUT IT CONTAINED NO BINDING COMMITMENTS TO SLOW GLOBAL WARMING.





IN 1896, THE SWEDISH SCIENTIST SVANTE ARRHENIUS CALCULATED HOW CHANGES IN THE AMOUNT OF CO₂ IN THE ATMOSPHERE COULD WARM OR COOL EARTH.



1896
Average CO₂ concentration 295 parts per million (p.p.m.)

THE
LONDON, EDINBURGH, AND DUBLIN
PHILOSOPHICAL MAGAZINE
AND
JOURNAL OF SCIENCE
APRIL 1896.

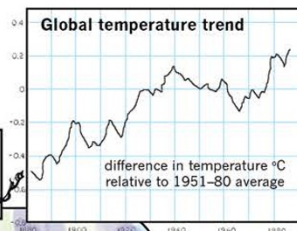
XXXI. On the Influence of Carbonic Acid in the Air upon the Temperature of the Ground. By Prof. Svante Arrhenius.

HE LATER SUGGESTED HUMANS WERE RAISING THE PLANET'S TEMPERATURE AND IT WOULD BECOME NOTICEABLE IN A FEW CENTURIES.

TABLE VII.—Variation of Temperature caused by a given Variation of Carbonic Acid.

Latitude	Carbonic Acid = 0.02					Carbonic Acid = 0.15					Carbonic Acid = 0.25					Carbonic Acid = 0.50					Carbonic Acid = 0.75				
	Jan.	Feb.	Mar.	Apr.	May	Jan.	Feb.	Mar.	Apr.	May	Jan.	Feb.	Mar.	Apr.	May	Jan.	Feb.	Mar.	Apr.	May	Jan.	Feb.	Mar.	Apr.	May
70°	-25	-30	-34	-38	-41	-25	-30	-34	-38	-41	-25	-30	-34	-38	-41	-25	-30	-34	-38	-41	-25	-30	-34	-38	-41
60°	-20	-25	-29	-33	-36	-20	-25	-29	-33	-36	-20	-25	-29	-33	-36	-20	-25	-29	-33	-36	-20	-25	-29	-33	-36
50°	-15	-20	-24	-28	-31	-15	-20	-24	-28	-31	-15	-20	-24	-28	-31	-15	-20	-24	-28	-31	-15	-20	-24	-28	-31
40°	-10	-15	-19	-23	-26	-10	-15	-19	-23	-26	-10	-15	-19	-23	-26	-10	-15	-19	-23	-26	-10	-15	-19	-23	-26
30°	-5	-10	-14	-18	-21	-5	-10	-14	-18	-21	-5	-10	-14	-18	-21	-5	-10	-14	-18	-21	-5	-10	-14	-18	-21
20°	-2	-7	-11	-15	-18	-2	-7	-11	-15	-18	-2	-7	-11	-15	-18	-2	-7	-11	-15	-18	-2	-7	-11	-15	-18
10°	0	-5	-9	-13	-16	0	-5	-9	-13	-16	0	-5	-9	-13	-16	0	-5	-9	-13	-16	0	-5	-9	-13	-16
0°	2	-3	-7	-11	-14	2	-3	-7	-11	-14	2	-3	-7	-11	-14	2	-3	-7	-11	-14	2	-3	-7	-11	-14
10°	4	-1	-5	-9	-12	4	-1	-5	-9	-12	4	-1	-5	-9	-12	4	-1	-5	-9	-12	4	-1	-5	-9	-12
20°	6	1	-3	-7	-10	6	1	-3	-7	-10	6	1	-3	-7	-10	6	1	-3	-7	-10	6	1	-3	-7	-10
30°	8	3	-1	-5	-8	8	3	-1	-5	-8	8	3	-1	-5	-8	8	3	-1	-5	-8	8	3	-1	-5	-8
40°	10	5	1	-3	-6	10	5	1	-3	-6	10	5	1	-3	-6	10	5	1	-3	-6	10	5	1	-3	-6
50°	12	7	3	-1	-4	12	7	3	-1	-4	12	7	3	-1	-4	12	7	3	-1	-4	12	7	3	-1	-4
60°	14	9	5	1	-2	14	9	5	1	-2	14	9	5	1	-2	14	9	5	1	-2	14	9	5	1	-2
70°	16	11	7	3	-1	16	11	7	3	-1	16	11	7	3	-1	16	11	7	3	-1	16	11	7	3	-1

THE CHANGES CAME MUCH FASTER THAN ARRHENIUS ANTICIPATED.



ON 23 JUNE 1988, NASA SCIENTIST JAMES HANSEN TOLD A US SENATE HEARING THAT HUMANS WERE HAVING A CLEAR IMPACT BY BURNING FOSSIL FUELS SUCH AS COAL, OIL AND NATURAL GAS.

"THE GREENHOUSE EFFECT HAS BEEN DETECTED, AND IT IS CHANGING OUR CLIMATE NOW."

IT WAS A WAKE-UP CALL TO THE WORLD.

1988
CO₂ 352 p.p.m.

THAT VERY DAY, THE TEMPERATURE IN WASHINGTON DC HIT A RECORD HIGH OF 98°F (37°C).

THE COUNTRY WAS SUFFERING ONE OF ITS WORST DROUGHTS EVER,

AND UNCONTROLLABLE FIRES RAGED IN YELLOWSTONE.

ON 22 DECEMBER 1988, THE ASSASSINATION OF BRAZILIAN ACTIVIST CHICO MENDES DREW ATTENTION TO THE RAMPANT DESTRUCTION OF THE AMAZON FOREST.



FOSSIL FUELS ARE NOT THE ONLY CAUSE OF WARMING. DEFORESTATION ALSO CONTRIBUTES BY RELEASING THE CO₂ STORED IN TREES.

ALARMED BY THE GROWING PROBLEM, THE UNITED NATIONS CREATED THE INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE (IPCC) IN 1988 TO ASSESS THE ISSUE.

ipcc



AT THE IPCC'S FIRST MEETING, THE DIRECTOR OF THE UNITED NATIONS ENVIRONMENT PROGRAMME, MOSTAFA TOLBA, IMPLORDED SCIENTISTS TO USE THE TIME LEFT IN THE CENTURY - JUST 4,000 DAYS - TO DEAL WITH CLIMATE CHANGE.

HOPES WERE HIGH BECAUSE THE WORLD HAD ALREADY TAKEN STEPS TO SOLVE ONE ENVIRONMENTAL DISASTER.

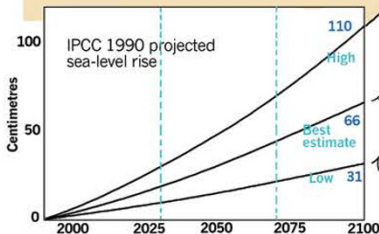
IN THE CASE OF GLOBAL WARMING, EVERYONE HAS A HAND IN THE PROBLEM BECAUSE SO MANY ACTIVITIES GENERATE GREENHOUSE GASES.

IN 1987, NATIONS ADOPTED A TREATY TO PROTECT THE OZONE LAYER.

BUT REACHING THAT AGREEMENT WAS RELATIVELY EASY BECAUSE ONLY A HANDFUL OF COMPANIES IN A FEW COUNTRIES PRODUCED OZONE-DESTROYING COMPOUNDS.

SO CURBING GREENHOUSE-GAS POLLUTION IS INFINITELY MORE DIFFICULT.

IN ITS FIRST REPORT, THE IPCC FORECASTED THAT IF CURRENT TRENDS CONTINUE UNTIL 2100, THE WORLD WOULD BE 4°C WARMER THAN IT WAS IN 1850. SWELLING OCEANS WOULD BE A MAJOR PROBLEM ...



...BECAUSE HALF OF HUMANITY INHABITS COASTAL REGIONS.

A MONSTROUS CYCLONE DROVE THAT POINT HOME IN 1991 WHEN IT KILLED MORE THAN 140,000 PEOPLE IN BANGLADESH.

THE RIO TREATY WAS CLEARLY NOT ENOUGH, SO NATIONS GATHERED IN 1995 IN BERLIN TO NEGOTIATE A STRONGER ACCORD.

1995
CO₂
361 p.p.m.

BUT THE ASSEMBLED COUNTRIES COULDN'T AGREE ON SPECIFICS.

ISLAND NATIONS WANTED RICH COUNTRIES - THE SOURCE OF MOST OF THE PROBLEM - TO CUT EMISSIONS BY 20%.

THE US DEMANDED THAT DEVELOPING NATIONS AGREE TO FUTURE COMMITMENTS.

CHINA SAID DEVELOPED NATIONS HAD TO ACT FIRST BECAUSE THEY HAD CAUSED THE PROBLEM.

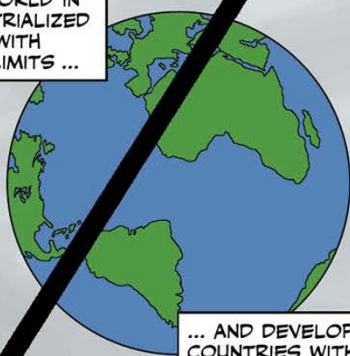
DURING ALL-NIGHT NEGOTIATIONS, GERMANY'S ENVIRONMENT MINISTER, ANGELA MERKEL, BROKERED A DEAL. COUNTRIES WOULD HAVE TWO YEARS TO AGREE ON EMISSIONS LIMITS FOR DEVELOPED NATIONS.

IN DECEMBER 1997, COUNTRIES GATHERED IN KYOTO, JAPAN, TO HASH OUT A NEW TREATY. BUT THEY COULDN'T AGREE ON HOW MUCH DEVELOPED NATIONS SHOULD TRIM THEIR EMISSIONS.



AFTER WORKING THROUGH THE FINAL NIGHT, NEGOTIATORS REACHED AN AGREEMENT CALLED THE KYOTO PROTOCOL. IT WAS THE FIRST TIME THAT COUNTRIES PROMISED TO REIN IN GREENHOUSE-GAS POLLUTION BY SPECIFIC AMOUNTS.

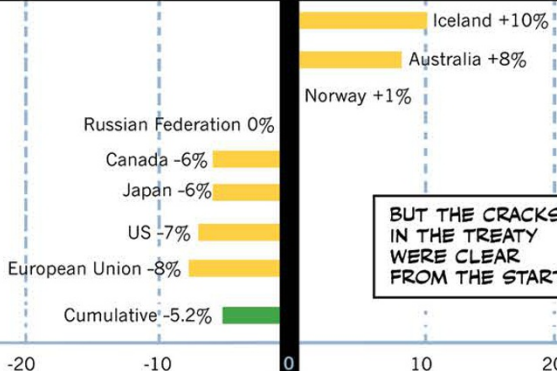
THE KYOTO PROTOCOL SPLIT THE WORLD IN TWO: INDUSTRIALIZED COUNTRIES WITH EMISSIONS LIMITS ...



... AND DEVELOPING COUNTRIES WITHOUT.

THE PROTOCOL ALSO ALLOWED FOR FLEXIBILITY IN HOW COUNTRIES MET THEIR COMMITMENTS. DEVELOPED NATIONS COULD GET CREDIT FOR REDUCING EMISSIONS IN POORER ONES.

DEVELOPED COUNTRIES PROMISED TO CUT THEIR OVERALL EMISSIONS TO 5.2% BELOW 1990 LEVELS FOR THE PERIOD 2008-12. EACH COUNTRY HAD ITS OWN TARGET.

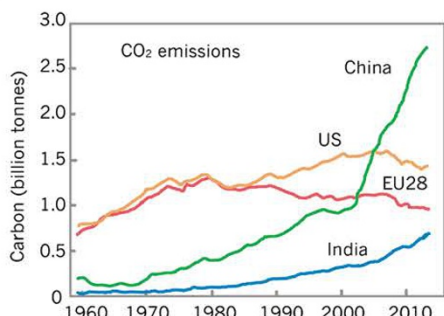


BUT THE CRACKS IN THE TREATY WERE CLEAR FROM THE START.

THE US REFUSED TO RATIFY THE PACT BECAUSE OF CONCERNS THAT ITS ECONOMY WOULD SUFFER WHILE DEVELOPING NATIONS INCREASED THEIR POLLUTION WITHOUT LIMITS.

IN 2001, US PRESIDENT GEORGE W. BUSH REJECTED THE AGREEMENT, SAYING "THE KYOTO PROTOCOL WAS FATALY FLAWED IN FUNDAMENTAL WAYS."

SOON, WORLD EVENTS MADE CLEAR HOW LIMITED THE PROTOCOL WAS. IN 2006, CHINA PASSED THE US TO BECOME THE WORLD'S LARGEST CARBON EMITTER.



CANADA FORMALLY WITHDREW FROM KYOTO IN 2011.



1998 HOTTEST YEAR

WASHINGTON - Earth was warmer in 1998 than in any other year on record, climate scientists reported Thursday. Studies of air and ocean temperatures by researchers in England and the United States both show that the average

MEANWHILE, GLOBAL TEMPERATURES CONTINUED TO SOAR.

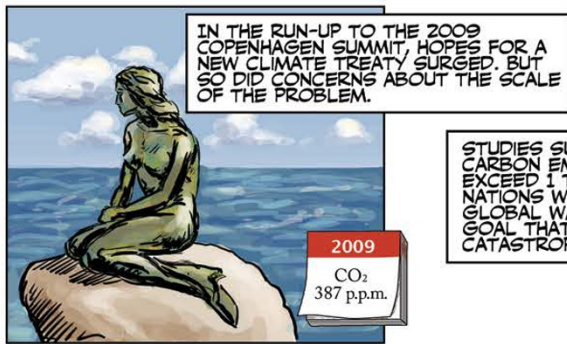
The average for the rest of the century, capping a general warming trend over the past few decades. Researchers blame the rising temperatures on greenhouse gases

Planet Daily
2014 HOTTEST YEAR ON RECORD

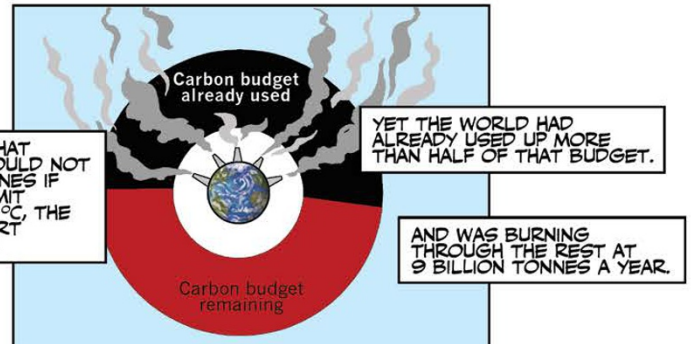
Planet Daily
2010 HOTTEST YEAR ON RECORD

Planet Daily
2005 HOTTEST YEAR ON RECORD

Planet Daily

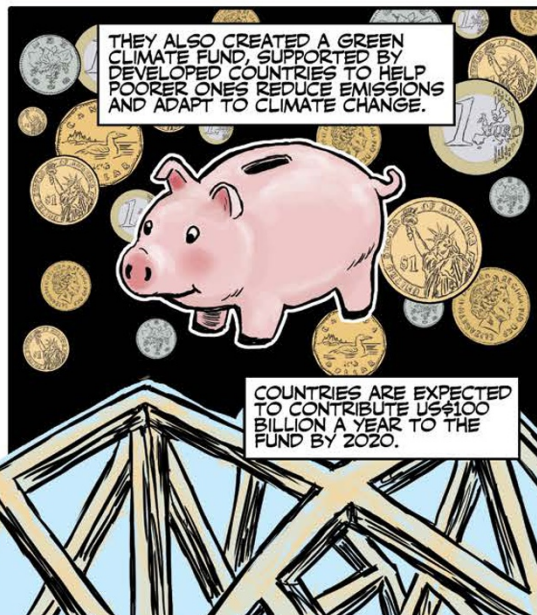
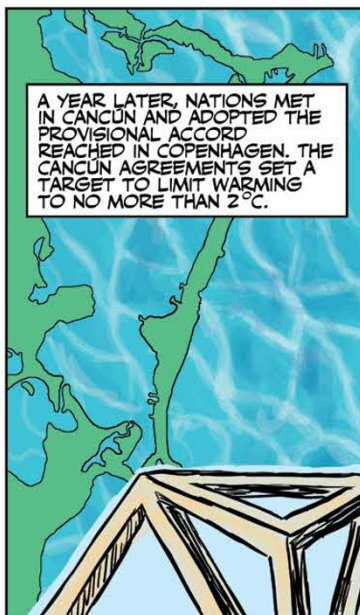
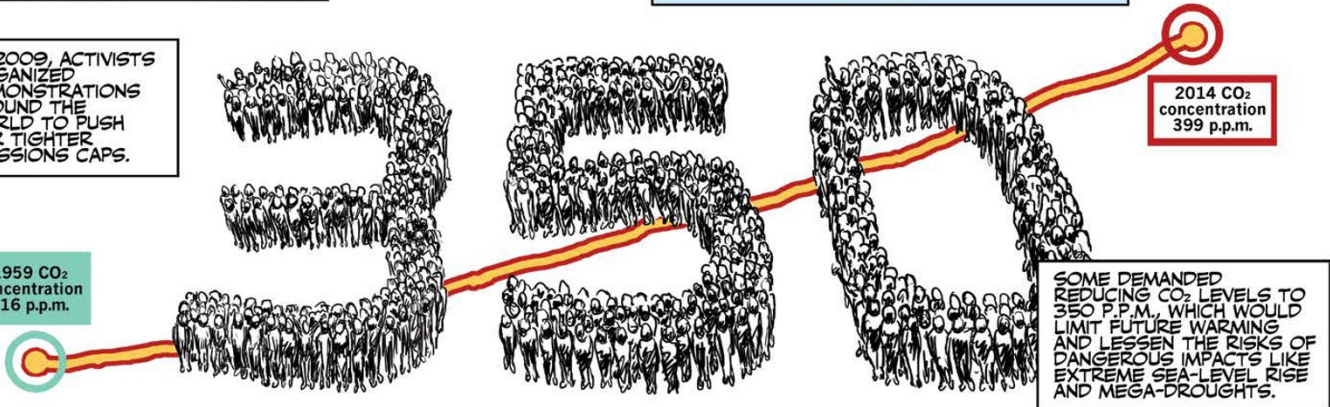


STUDIES SUGGESTED THAT CARBON EMISSIONS SHOULD NOT EXCEED 1 TRILLION TONNES IF NATIONS WANTED TO LIMIT GLOBAL WARMING TO 2°C, THE GOAL THAT WOULD AVERT CATASTROPHIC CHANGE.



IN 2009, ACTIVISTS ORGANIZED DEMONSTRATIONS AROUND THE WORLD TO PUSH FOR TIGHTER EMISSIONS CAPS.

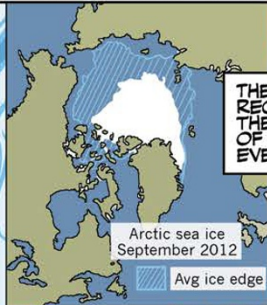
1959 CO₂
concentration
316 p.p.m.



AS THE NEGOTIATIONS HAVE CRAWLED ALONG, THE WORLD HAS HURLED THROUGH CHANGES.

IN OCTOBER 2011, THE GLOBAL POPULATION TOPPED 7 BILLION PEOPLE.

IN 2012, 97% OF THE GREENLAND ICE SHEET SHOWED SIGNS OF MELTING – THE FIRST TIME SUCH AN EXTENSIVE AREA HAD THAWED.



THE ARCTIC SEA SET A RECORD IN 2012 FOR THE LEAST AMOUNT OF ICE COVERAGE EVER DOCUMENTED.

NOVEMBER 2013: SUPERSTORM HAIYAN BECAME THE STRONGEST ON RECORD TO MAKE LANDFALL WHEN IT SLAMMED INTO THE PHILIPPINES WITH WINDS OF 315 KILOMETRES PER HOUR.

A HEAT WAVE IN RUSSIA IN 2010 KILLED ROUGHLY 55,000 PEOPLE AND STOKED WILDFIRES ACROSS THE COUNTRY.



AT CLIMATE TALKS IN 2013, PHILIPPINE DELEGATE NADEREV SANO BROKE DOWN OVER HIS COUNTRY'S DEVASTATION AND THE LACK OF PROGRESS IN NEGOTIATIONS.



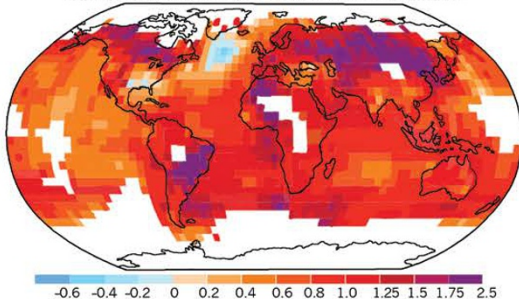
"BY FAILING TO MEET THE OBJECTIVE OF THE CONVENTION, WE MAY HAVE RATIFIED THE DOOM OF VULNERABLE COUNTRIES."

9 MAY 2013: DAILY ATMOSPHERIC MEASUREMENTS OF CO₂ AT A STATION IN HAWAII TOPPED 400 P.P.M. FOR THE FIRST TIME IN, PERHAPS, MILLIONS OF YEARS.



JAMES HANSEN, WHO HAD SOUNDED THE ALARM OVER GLOBAL WARMING, WAS ARRESTED SEVERAL TIMES FOR PROTESTS OVER THE PROPOSED KEYSTONE XL PIPELINE.

Observed change in surface temperature 1901–2012



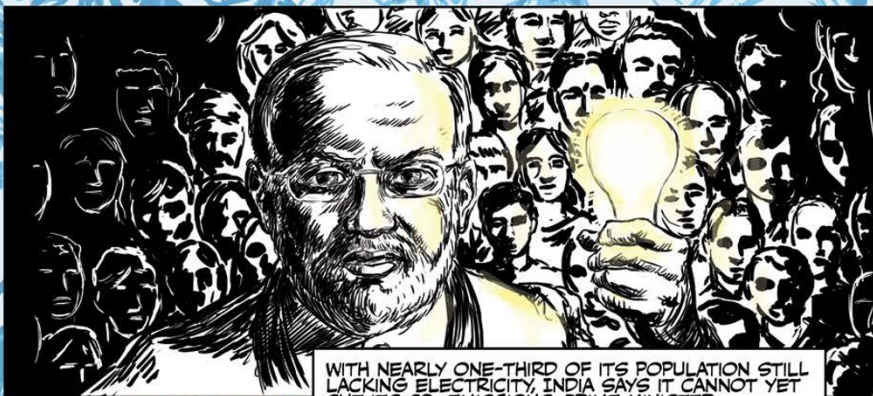
IN SEPTEMBER 2013, THE IPCC REPORTED THAT "HUMAN INFLUENCE ON THE CLIMATE SYSTEM IS CLEAR."

2014: CHINA OVERTOOK THE EUROPEAN UNION IN PER CAPITA EMISSIONS OF CO₂.



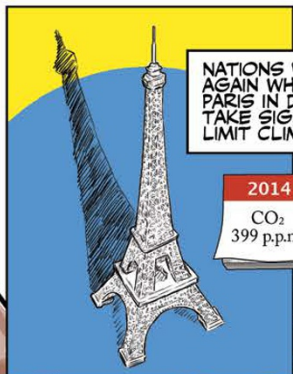
THE US AND CHINA BROKERED A HISTORIC CLIMATE DEAL IN NOVEMBER 2014. THE US PLEDGED TO CUT GREENHOUSE-GAS EMISSIONS 26–28% BELOW 2005 LEVELS BY 2025. CHINA SAID ITS EMISSIONS WOULD PEAK AROUND 2030.

THESE BECAME THE BASIS FOR WHAT THE TWO COUNTRIES SUBMITTED TO THE UNFCCC AS THEIR PROPOSED EMISSIONS TARGETS IN ADVANCE OF THE PARIS SUMMIT. SO FAR, MORE THAN 160 COUNTRIES HAVE SUBMITTED THEIR PLEDGES.



WITH NEARLY ONE-THIRD OF ITS POPULATION STILL LACKING ELECTRICITY, INDIA SAYS IT CANNOT YET CUT ITS CO₂ EMISSIONS. PRIME MINISTER NARENDRA MODI'S GOVERNMENT PLEDGED TO SUBSTANTIALLY INCREASE ENERGY EFFICIENCY.

2014 SET THE RECORD AS THE HOTTEST YEAR EVER RECORDED FOR GLOBAL LAND AND SEA SURFACE TEMPERATURES.



NATIONS WILL FACE A TEST AGAIN WHEN THEY MEET IN PARIS IN DECEMBER: CAN THEY TAKE SIGNIFICANT STEPS TO LIMIT CLIMATE CHANGE?

2014
CO₂
399 p.p.m.



THE CALLS FOR ACTION - AND THE WARNING SIGNS - GROW STRONGER.

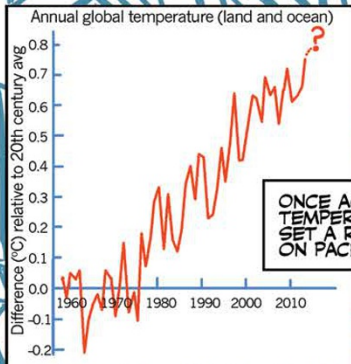
"CLIMATE CHANGE IS A GLOBAL PROBLEM WITH GRAVE IMPLICATIONS IT REPRESENTS ONE OF THE PRINCIPAL CHALLENGES FACING HUMANITY IN OUR DAY."

POPE FRANCIS



"ALTHOUGH WE'RE MOVING IN THE RIGHT DIRECTION, IT IS CLEARLY NOT ENOUGH."

CHRISTIANA FIGUERES,
EXECUTIVE SECRETARY
OF THE UNFCCC



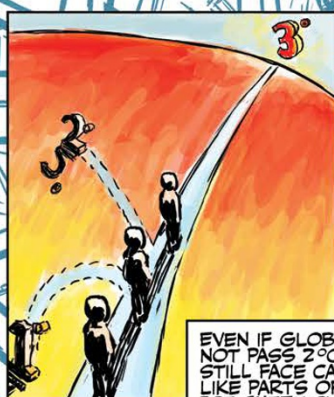
ONCE AGAIN, GLOBAL TEMPERATURES WILL SET A RECORD. 2015 IS ON PACE TO TOP 2014.

FIRES IN INDONESIA RAVAGED THE COUNTRY AND PUMPED HALF A BILLION TONNES OF CARBON INTO THE AIR, MORE THAN JAPAN PRODUCES IN A YEAR.



THE PARIS PLEDGES WILL PROBABLY LIMIT WARMING TO BELOW 3°C. BUT MUCH STRONGER ACTION IS NEEDED TO STAY UNDER 2°C. COUNTRIES WILL PROBABLY BLOW THROUGH THE TRILLION-TONNE CARBON BUDGET BEFORE 2040.

CO₂ CONTINUES TO THICKEN THE SKIES. CONCENTRATIONS MAY NEVER AGAIN DROP BELOW 400 P.P.M.



EVEN IF GLOBAL WARMING DOES NOT PASS 2°C, THE WORLD MIGHT STILL FACE CALAMITOUS IMPACTS, LIKE PARTS OF THE ANTARCTIC ICE SHEET SLIDING INTO THE OCEAN WITHIN A FEW CENTURIES.



THE WORLD HAS COME A LONG WAY SINCE KYOTO. THIS YEAR, ALL COUNTRIES ARE SETTING THEIR OWN GOALS, WHICH MAY MAKE THE TARGETS MORE REALISTIC. AND NATIONS MAY AGREE TO STEP UP THEIR COMMITMENTS PERIODICALLY.

THE FRAMEWORK TO FIX THE PLANET IS COMING TOGETHER BUT IT IS FRAGILE AND FAR TOO SMALL. THE JOB OF FINISHING THE TASK WILL FALL TO FUTURE GENERATIONS.

THE FRAGILE FRAMEWORK

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For more on the Paris climate talks,
see: nature.com/parisclimate