Climate Change and Health

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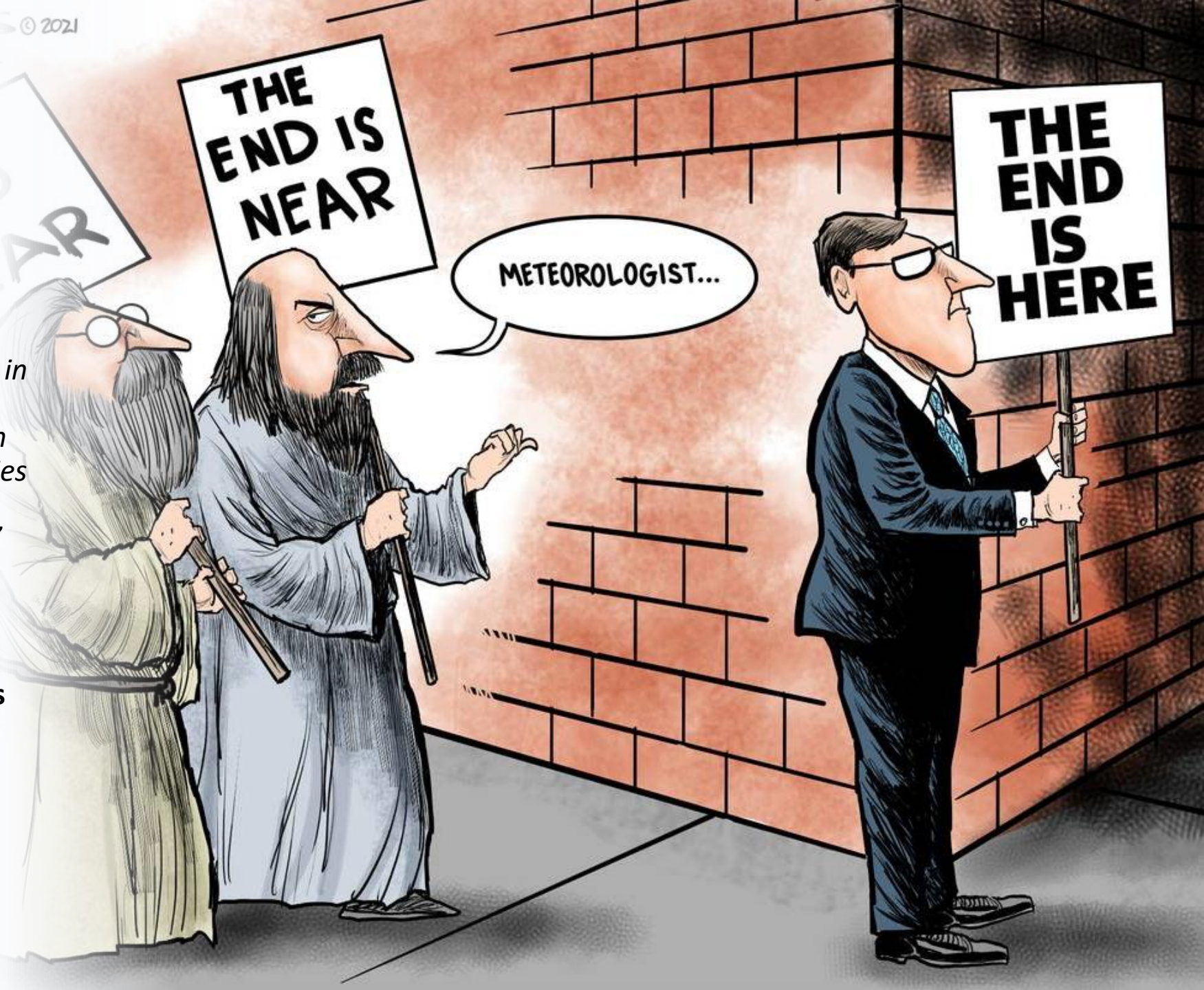
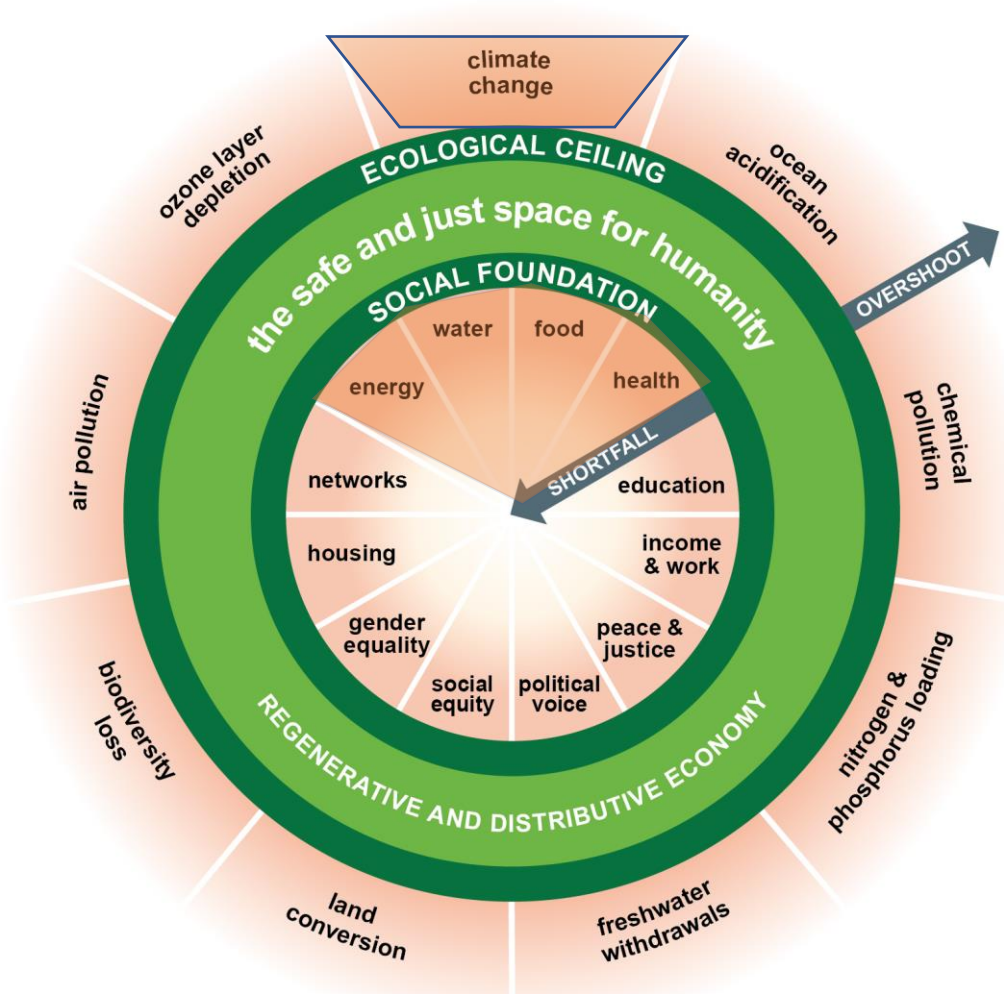
What is Climate Change?

- *"Climate change refers to a change in the state of the climate that can be identified … by changes in the mean and/or the variability of its properties and that persists for an extended period, typically decades or longer."*

IPCC Glossary, 2022

- General **warming observed across the globe**
- **Anthropogenic emissions** of greenhouse gasses.





Looking at the Planetary doughnut model, climate change will have multiple effects on human society, especially where energy, water, food and health are concerned.


THE LANCET

Submit Article

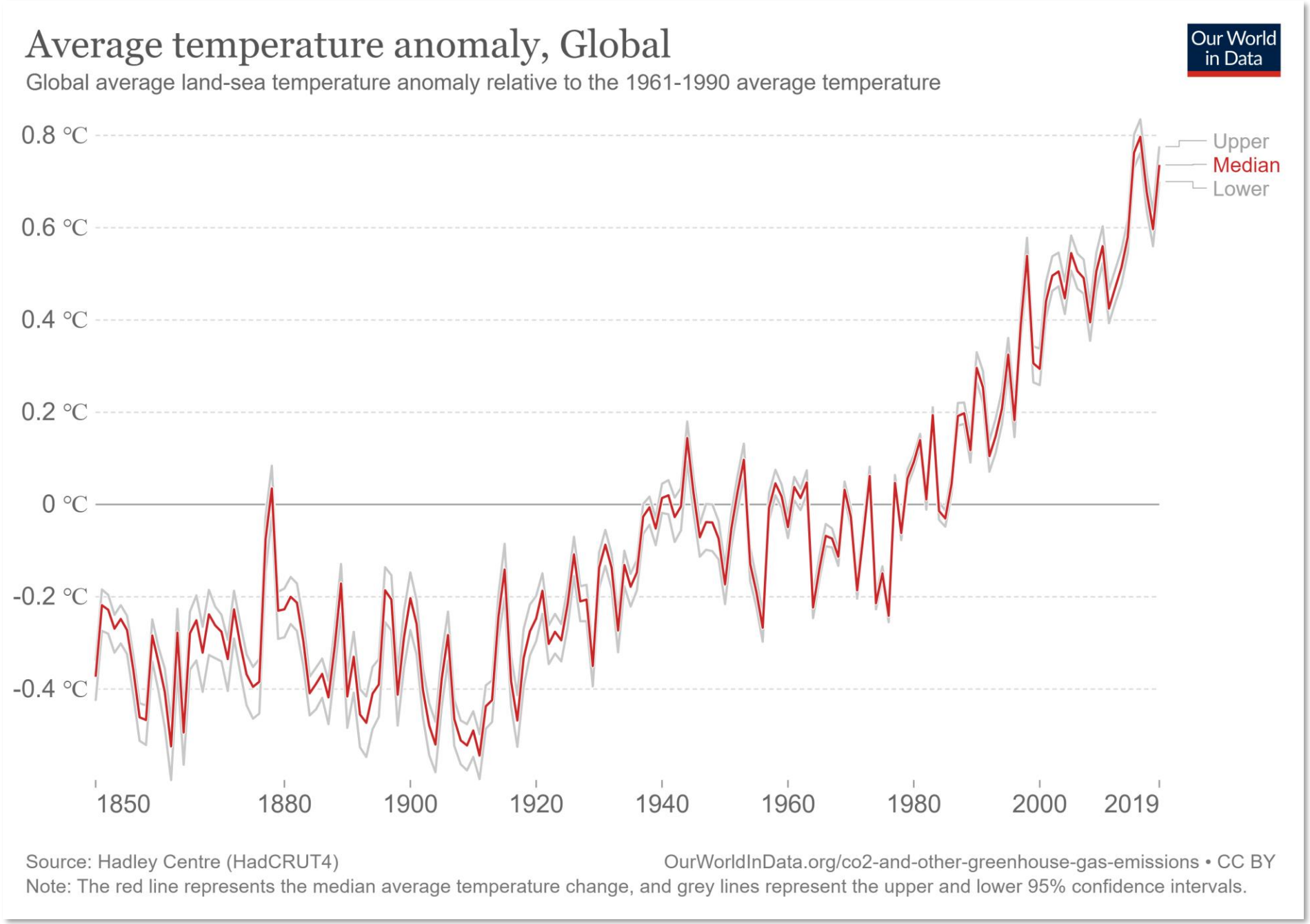
INFOGRAPHICS

Lancet Countdown on Health and Climate Change,

October 25, 2022

The world is at a critical juncture in its response to climate change. Worldwide, people are seeing their health increasingly affected by climate change amidst the compounding impacts of COVID-19 and the cost of living and energy crises; governments and companies continue to prioritise fossil fuels over a healthy future despite climate commitments; and rapid, holistic action is the only route to ensuring a just and healthy future.

Source: https://doughnuteconomics.org/about-doughnut-economics

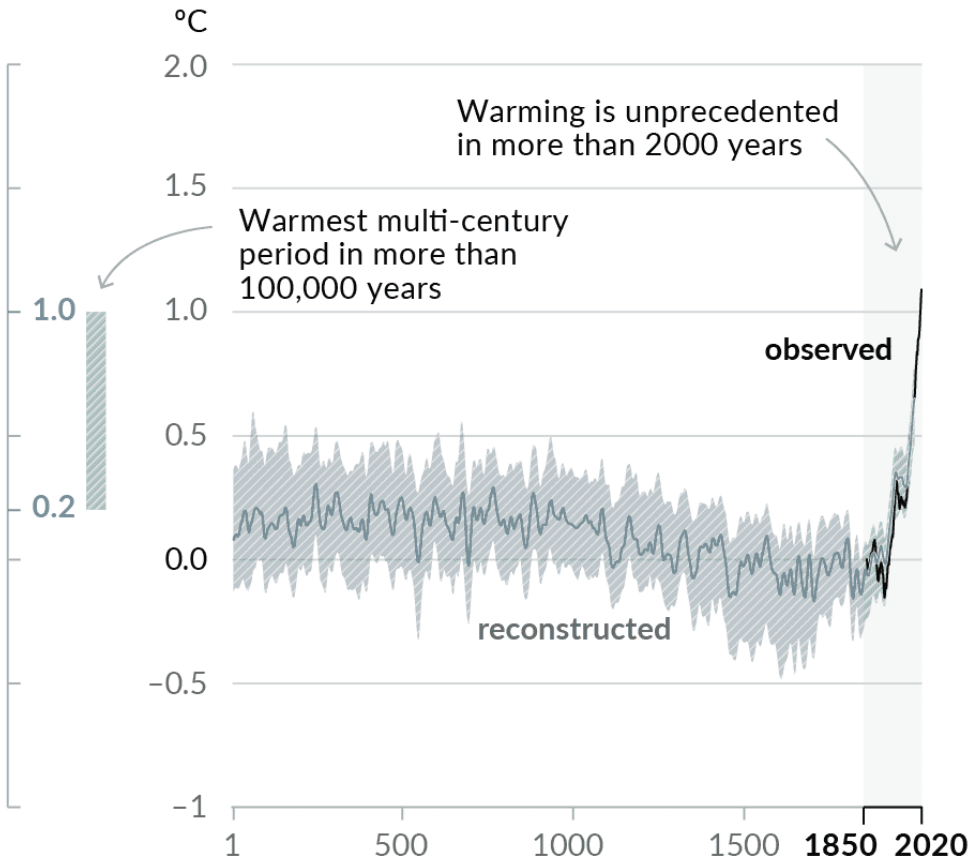


We are currently hovering around 1.27°C above preindustrial levels.

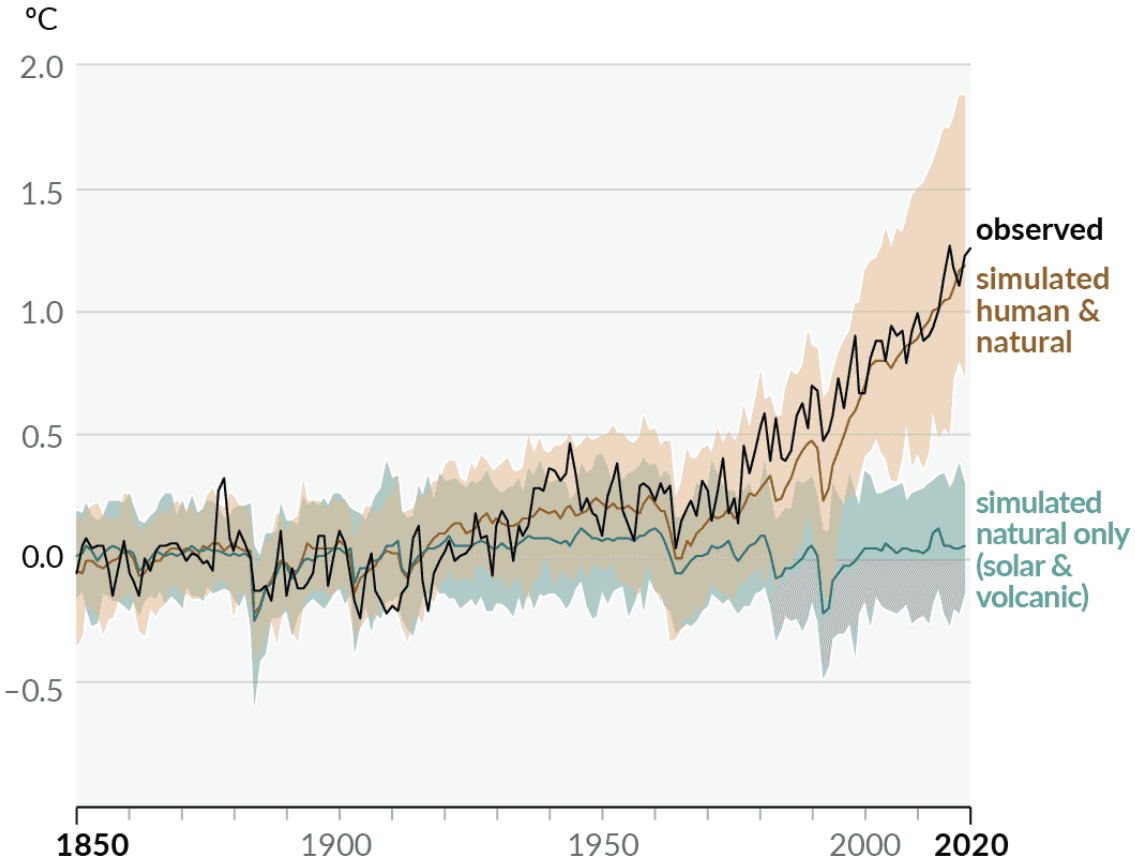
Human influence has warmed the climate at a rate that is unprecedented in at least the last 2000 years

Changes in global surface temperature relative to 1850–1900

(a) Change in global surface temperature (decadal average) as reconstructed (1–2000) and **observed** (1850–2020)



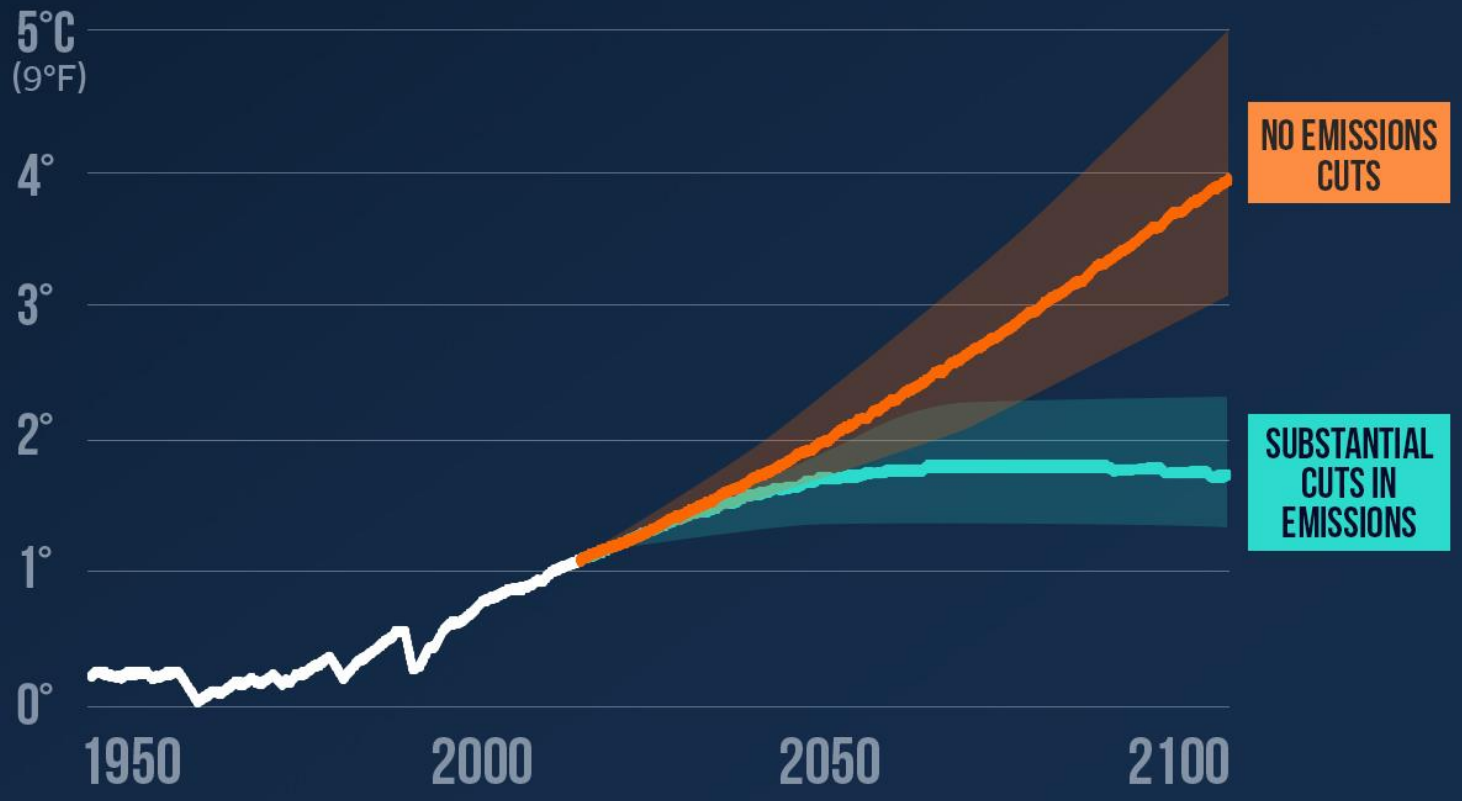
(b) Change in global surface temperature (annual average) as **observed** and simulated using human & natural and only natural factors (both 1850–2020)



Source: https://www.ipcc.ch/report/ar6/wg1/chapter/summary-for-policymakers/

FUTURE TEMPERATURES

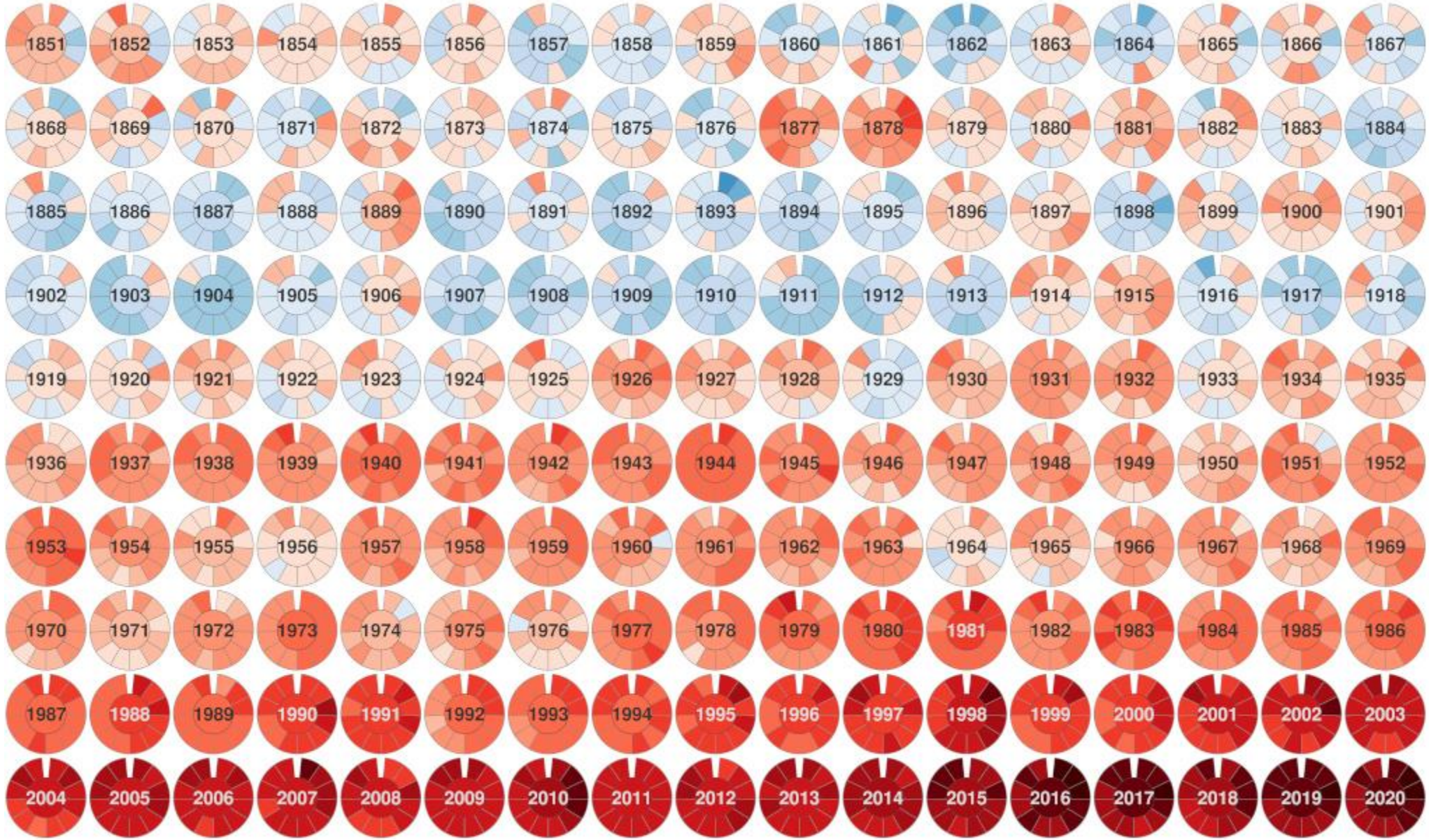
WARMING DEPENDS ON CHOICES TODAY

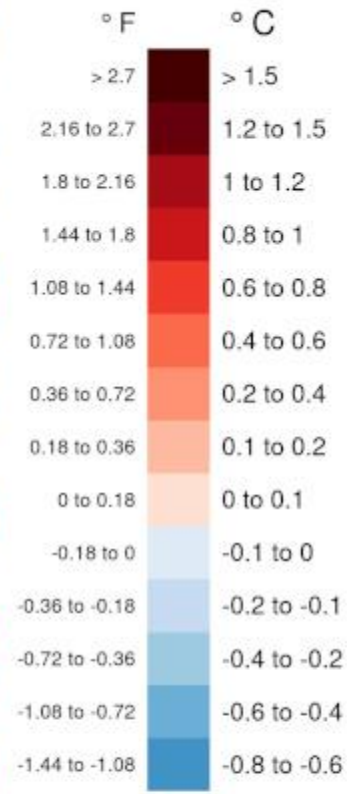


Global surface temperature (°C) anomaly relative to 1850-1900
High warming scenario: SSP3-7, Low warming scenario from SSP1-2.6.
Source: IPCC AR6 WG1

CLIMATE CENTRAL

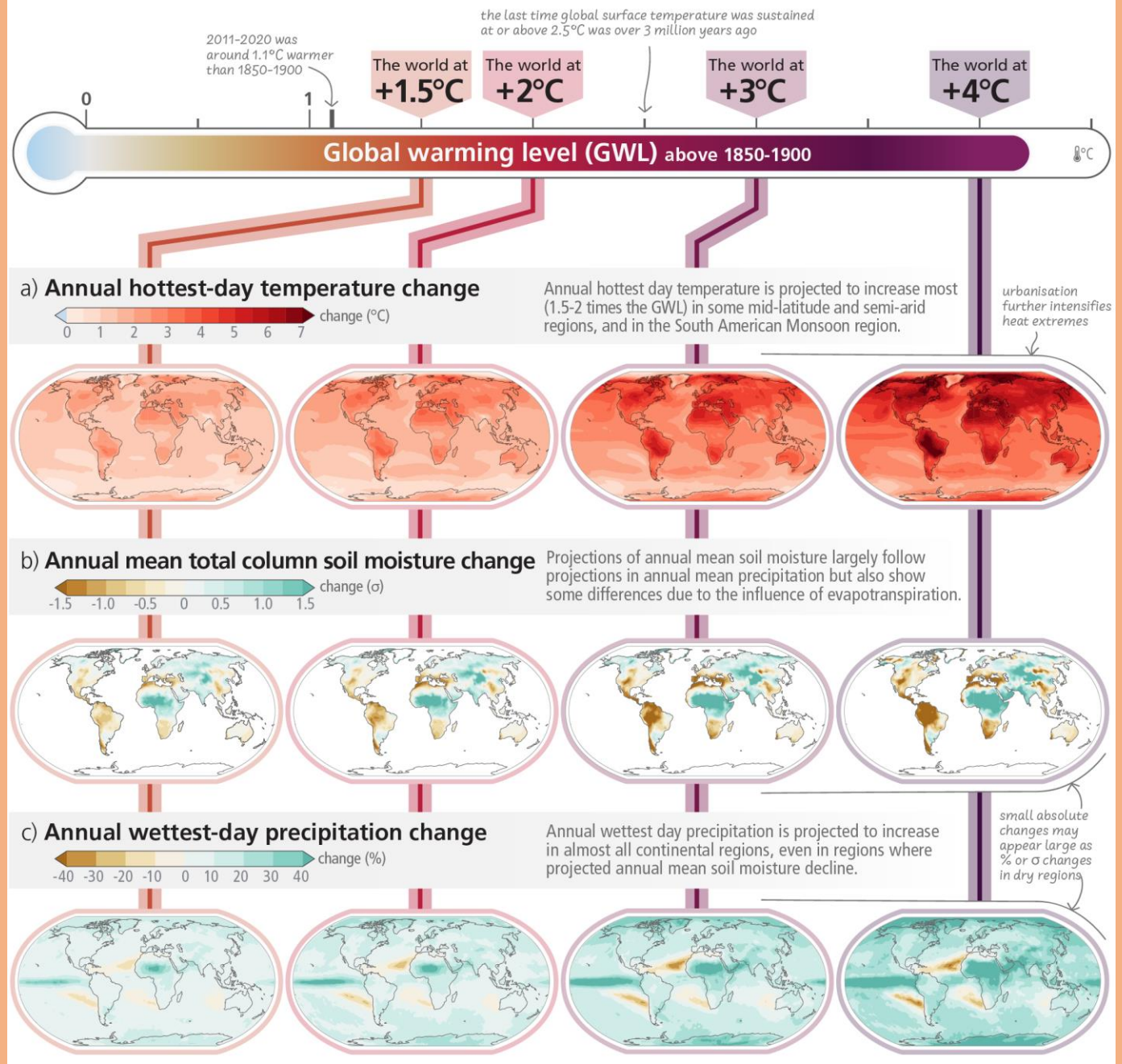
Monthly global mean temperature 1851 to 2020 (compared to 1850-1900 averages)



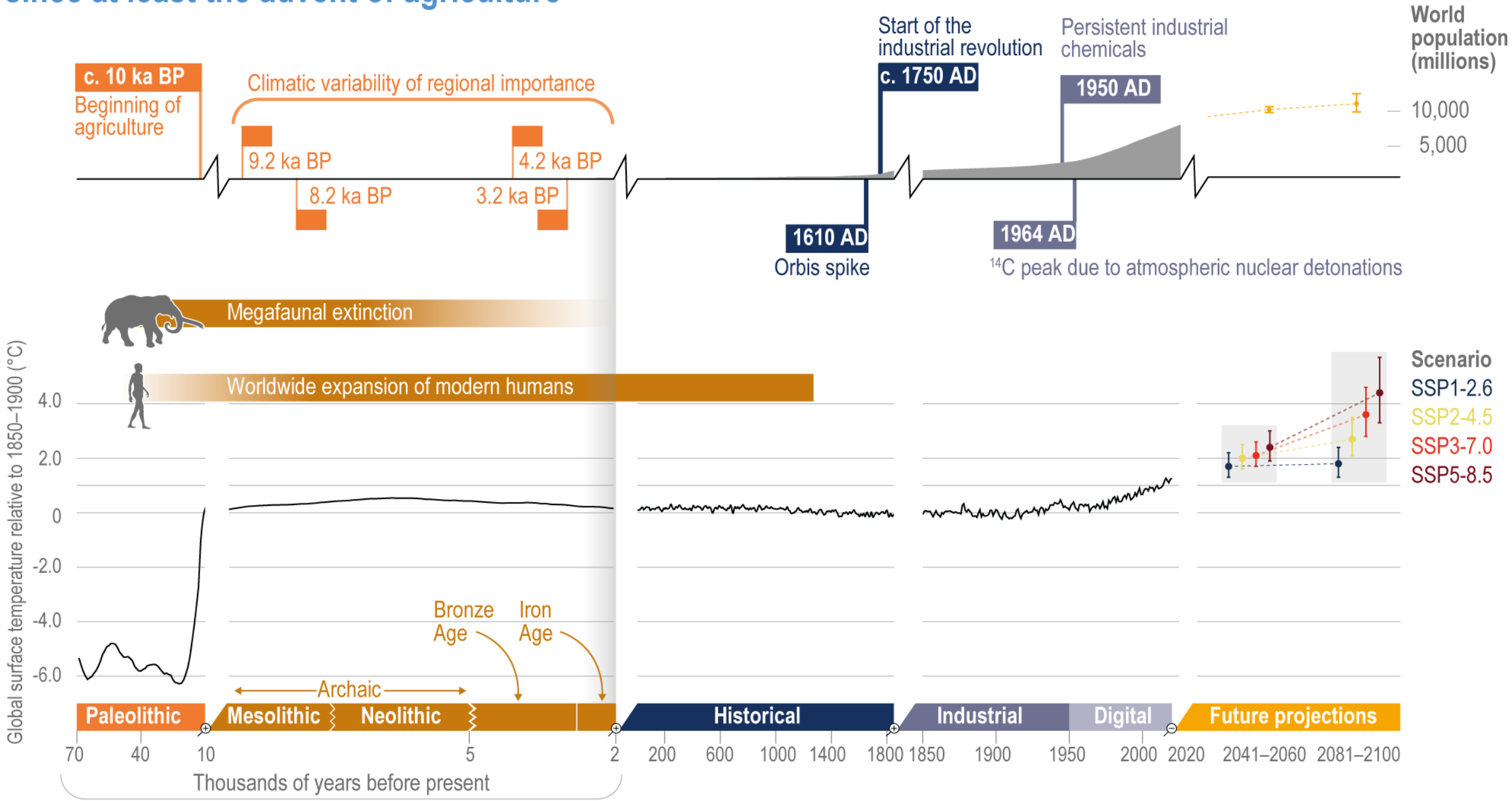


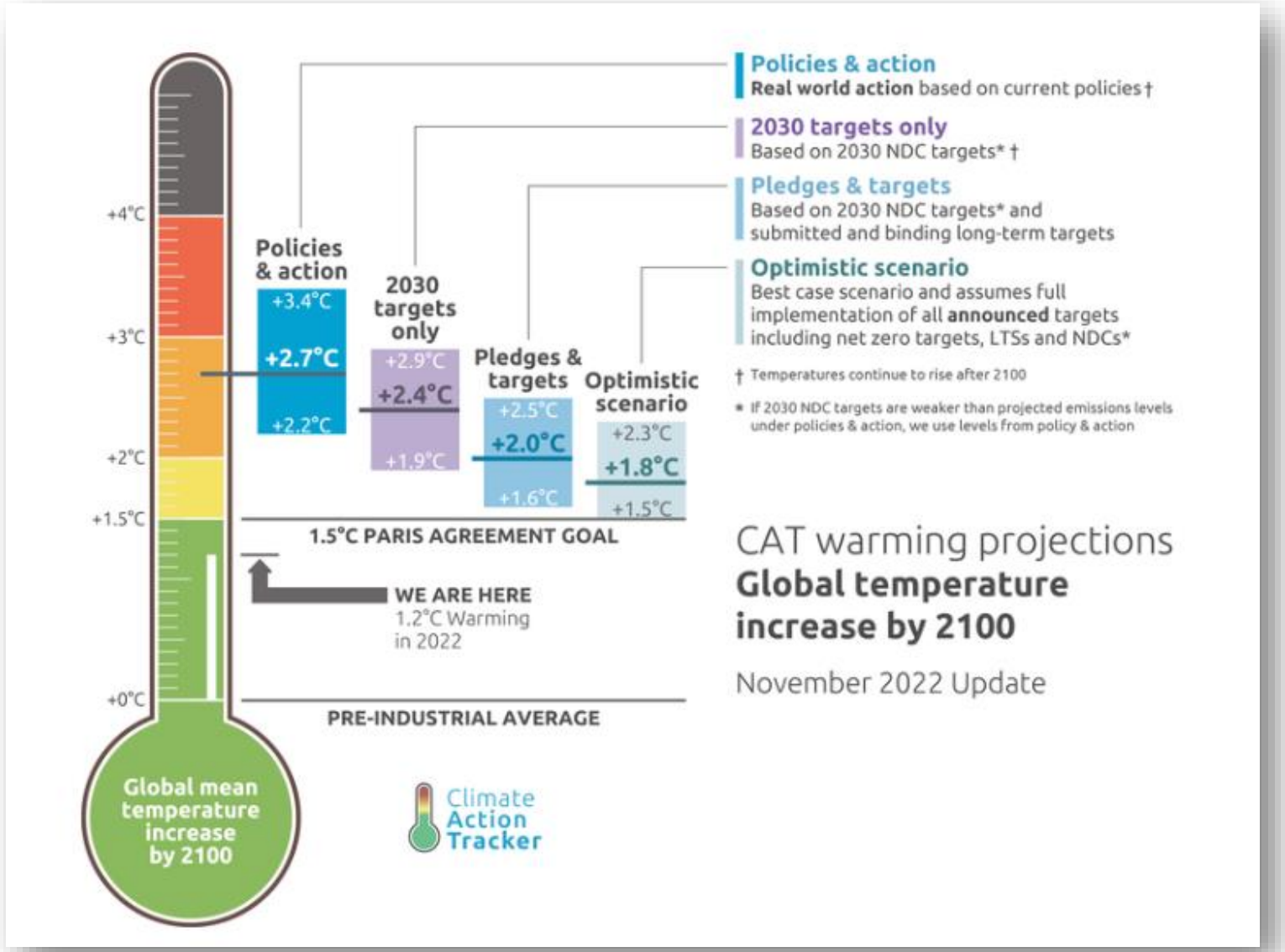
Data: HadCRUT5 - Created by: @neilrkaye

With every increment of global warming, regional changes in mean climate and extremes become more widespread and pronounced



Humankind is embarking on a trajectory beyond the global temperatures experienced since at least the advent of agriculture




+4°C
+3°C
+2°C
+1.5°C
+0°C
Policies & action
+3.4°C
+2.7°C
+2.2°C
2030 targets only
+2.9°C
+2.4°C
+1.9°C
Pledges & targets
+2.5°C
+2.0°C
+1.6°C
Optimistic scenario
+2.3°C
+1.8°C
+1.5°C
1.5°C PARIS AGREEMENT GOAL
WE ARE HERE
1.2°C Warming in 2022
PRE-INDUSTRIAL AVERAGE
Global mean temperature increase by 2100
Climate Action Tracker
Policies & action
Real world action based on current policies †
2030 targets only
Based on 2030 NDC targets* †
Pledges & targets
Based on 2030 NDC targets* and submitted and binding long-term targets
Optimistic scenario
Best case scenario and assumes full implementation of all announced targets including net zero targets, LTSs and NDCs*
† Temperatures continue to rise after 2100
* If 2030 NDC targets are weaker than projected emissions levels under policies & action, we use levels from policy & action
CAT warming projections
Global temperature increase by 2100
November 2022 Update

2100 WARMING PROJECTIONS

Emissions and expected warming based on pledges and current policies

Climate Action Tracker **Nov 2022** Update

Global GHG emissions $GtCO_2e$ / year

70
60
50
40
30
20
10
0
-10
-20

1990 2000 2010 2020 2030 2040 2050 2060 2070 2080 2090 2100

Historical

2030 target gap
19 – 22 $GtCO_2e$

2030 Implementation gap
23 – 27 $GtCO_2e$

Warming projected by 2100

+2.9°C High

Policies & action

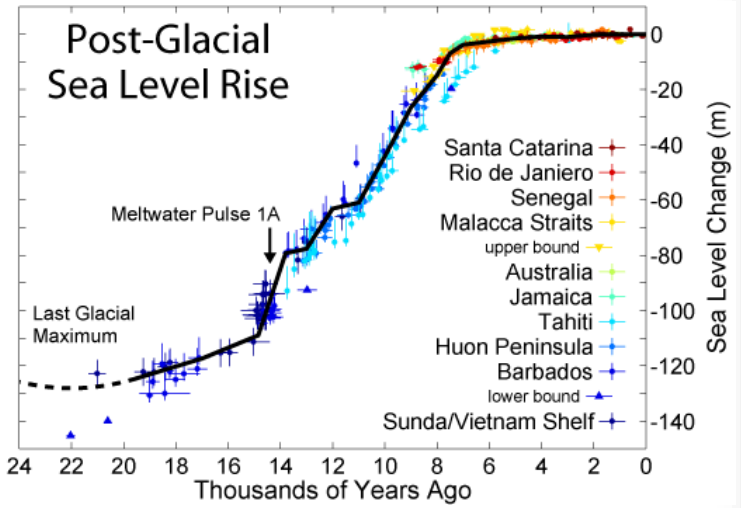
+2.6°C Low

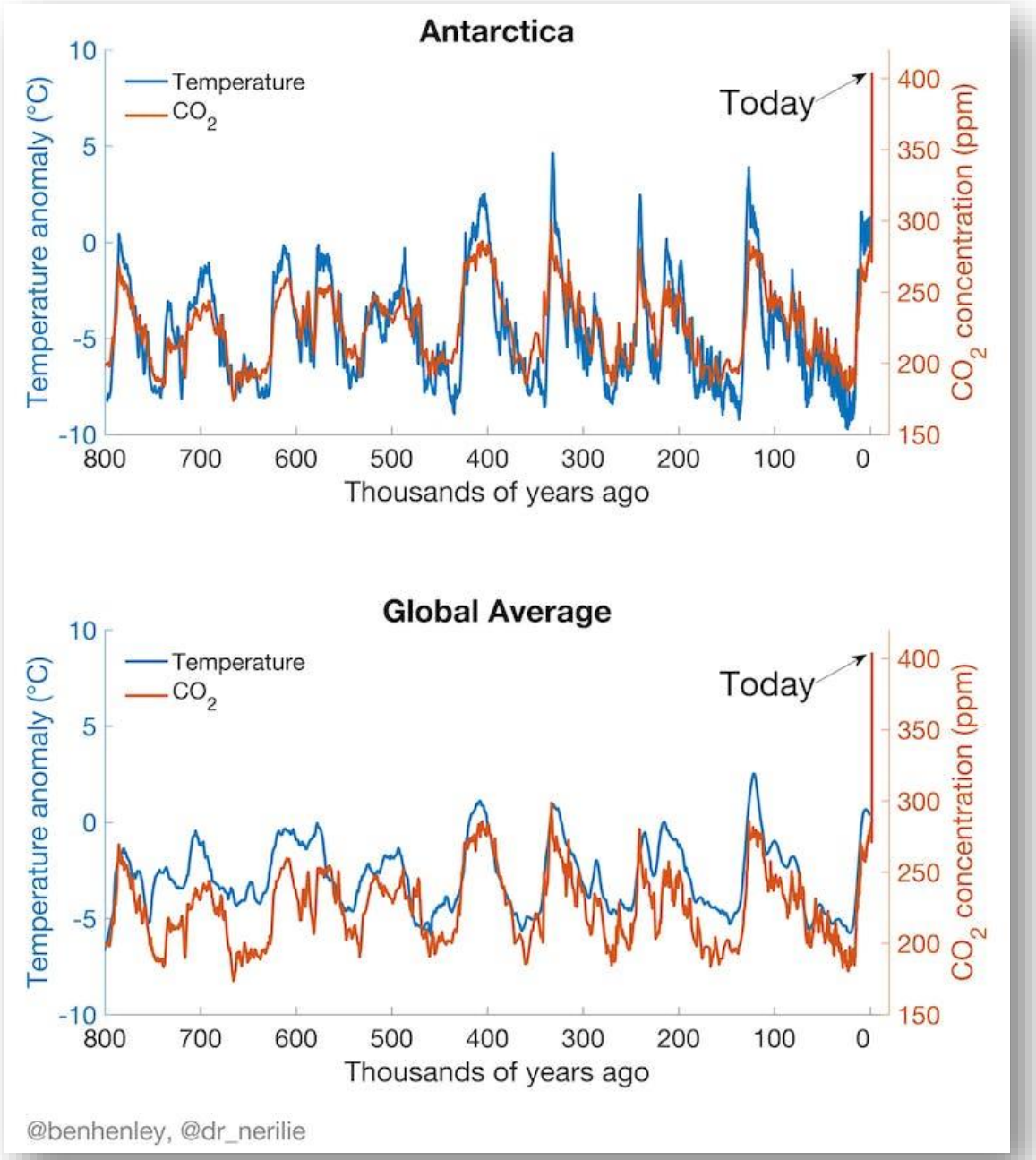
2030 targets only
+2.4°C

Pledges & targets
+2.0°C

Optimistic scenario
+1.8°C

1.5°C compatible





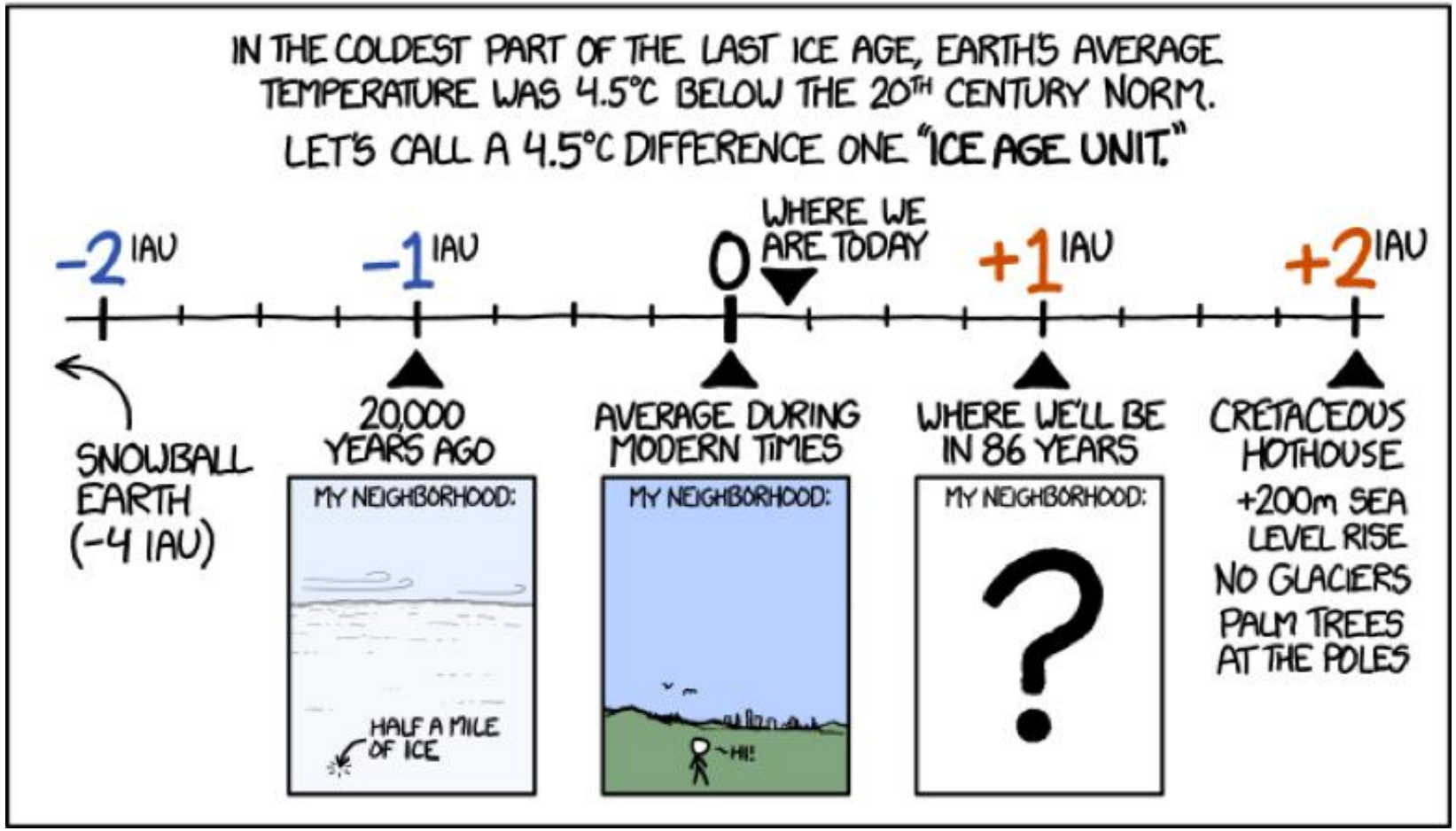
We are currently hovering around 1.27°C above preindustrial levels.

Heading to 2.5 °C even 4 °C .

If 4 °C one way meant a vastly different world, heading to 4 °C the other way be as drastically different.

WITHOUT PROMPT, AGGRESSIVE LIMITS ON CO_2 EMISSIONS, THE EARTH WILL LIKELY WARM BY AN AVERAGE OF 4°-5°C BY THE CENTURY'S END.

HOW BIG A CHANGE IS THAT?



CLIMATE CHANGE IS A ‘WICKED PROBLEM’

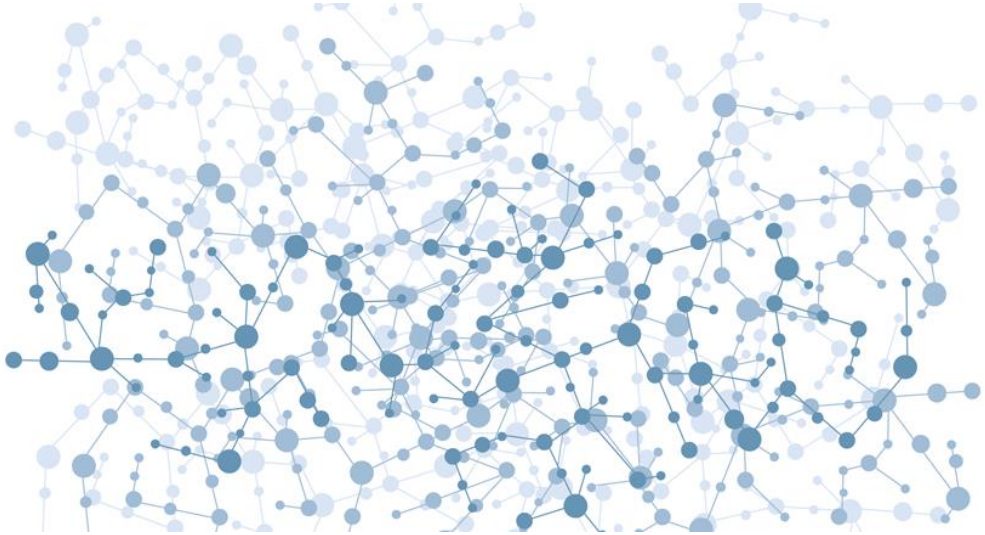
COMPLEXITY

Difficulty in defining causal linkages of an event and determining its boundaries

INHERENT INTERRELATEDNESS

Changing one factor can have multiple unknown effects, of unknown magnitude, and unknown consequences.

Changing one factor often leads to a new set of wicked problems.



“ The problems that scientists and engineers have usually focused upon are mostly "tame" or "benign" ones. As an example, consider a problem of mathematics, such as solving an equation… the mission is clear. It is clear, in turn, whether or not the problems have been solved.

Wicked problems, in contrast, have neither of these clarifying traits…”

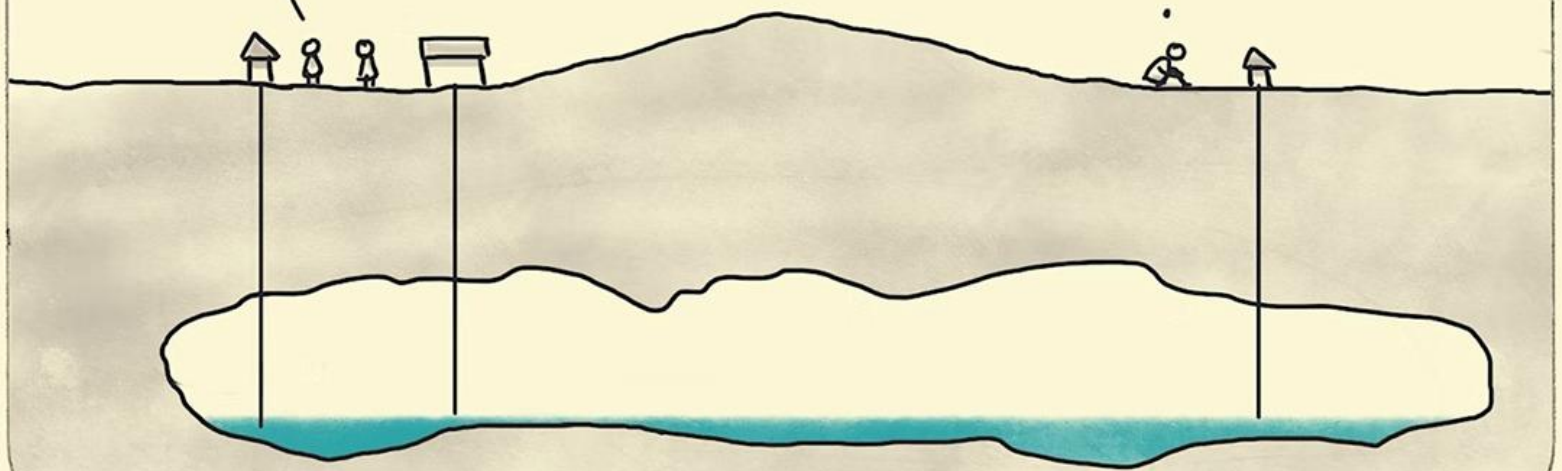
Rittel and Webber, 1973

THE TRAGEDY OF THE COMMONS

WHEN SHORT-TERM SELF-INTEREST LEADS TO TRAGEDY FOR ALL

WATER BELONGS TO ANYONE. I TAKE AS MUCH AS I WANT

SEEMS THERE'S LESS AND LESS THESE DAYS



sketchplanations

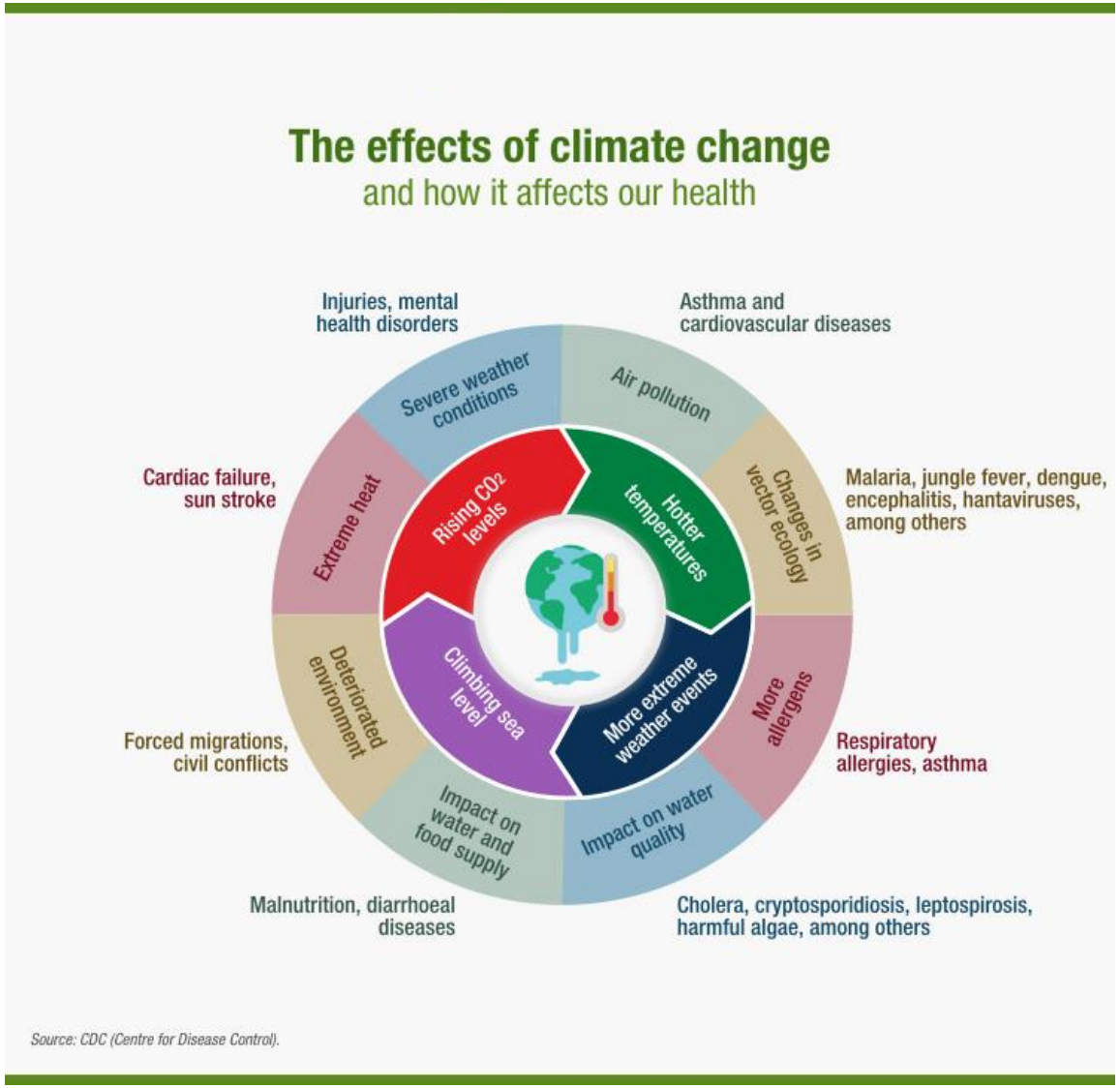
How does climate change impact health?

- **Complex, multiple pathways**.
- **They are significant and measurable** (McMichael *et al*, 2006).
- **150,000 deaths** were attributable to climate change annually by the year 2000. This could reach at least 250,000 deaths annually between 2030 and 2050 (WHO, 2021).

Effects felt strongly in:

- All countries

- Disproportionally so in poorer countries



Source: WHO, 2021. Available from: https://www.who.int/news-room/fact-sheets/detail/climate-change-and-health

Climate change

Vulnerability

Vulnerability factors

- Demographic factors
- Geographic factors
- Biological factors & health status
- Sociopolitical conditions
- Socioeconomic factors

Exposure pathways

- Extreme weather events
- Heat stress
- Air quality
- Water quality and quantity
- Food security and safety
- Vector distribution & ecology

Health system capacity & resilience

- Leadership & governance
- Health workforce
- Health information systems
- Essential medical products & technologies
- Service delivery
- Financing

Climate-sensitive health risks

Health outcomes

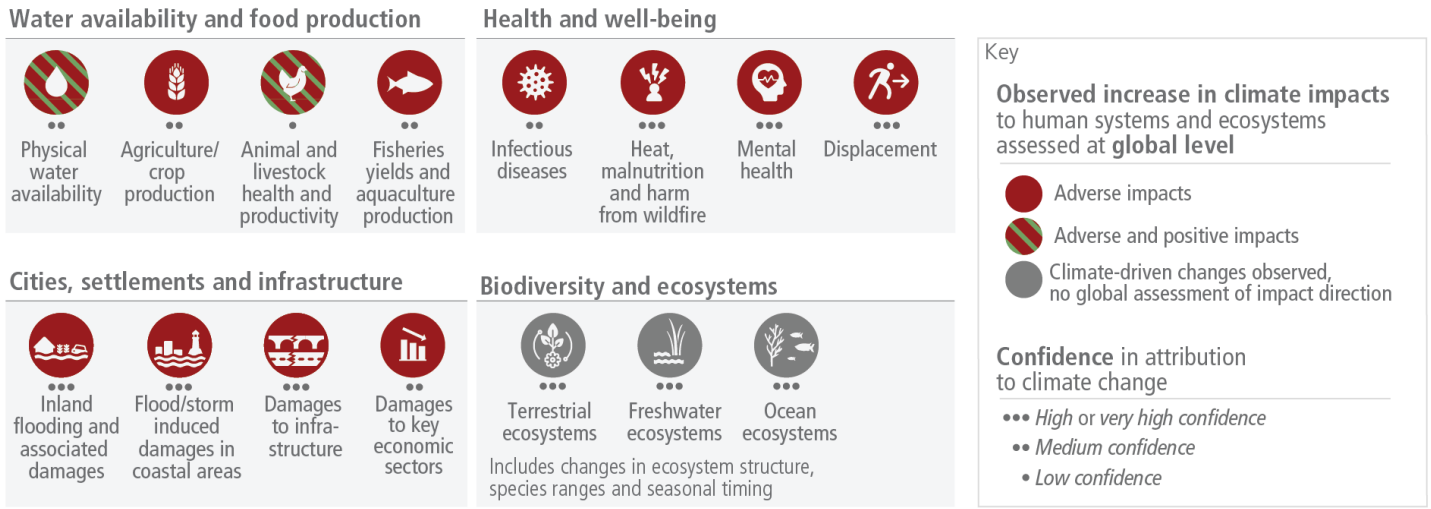
- Injury and mortality from extreme weather events
- Heat-related illness
- Respiratory illness
- Water-borne diseases and other water-related health impacts
- Zoonoses
- Vector-borne diseases
- Malnutrition and food-borne diseases
- Noncommunicable diseases (NCDs)
- Mental and psychosocial health

Health systems & facilities outcomes

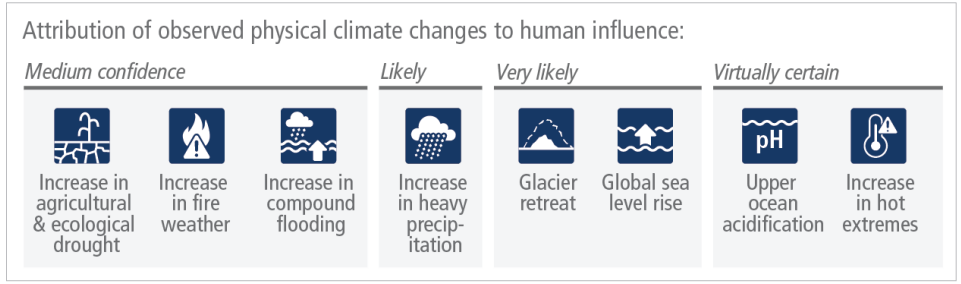
- Impacts on healthcare facilities
- Effects on health systems

Adverse impacts from human-caused climate change will continue to intensify

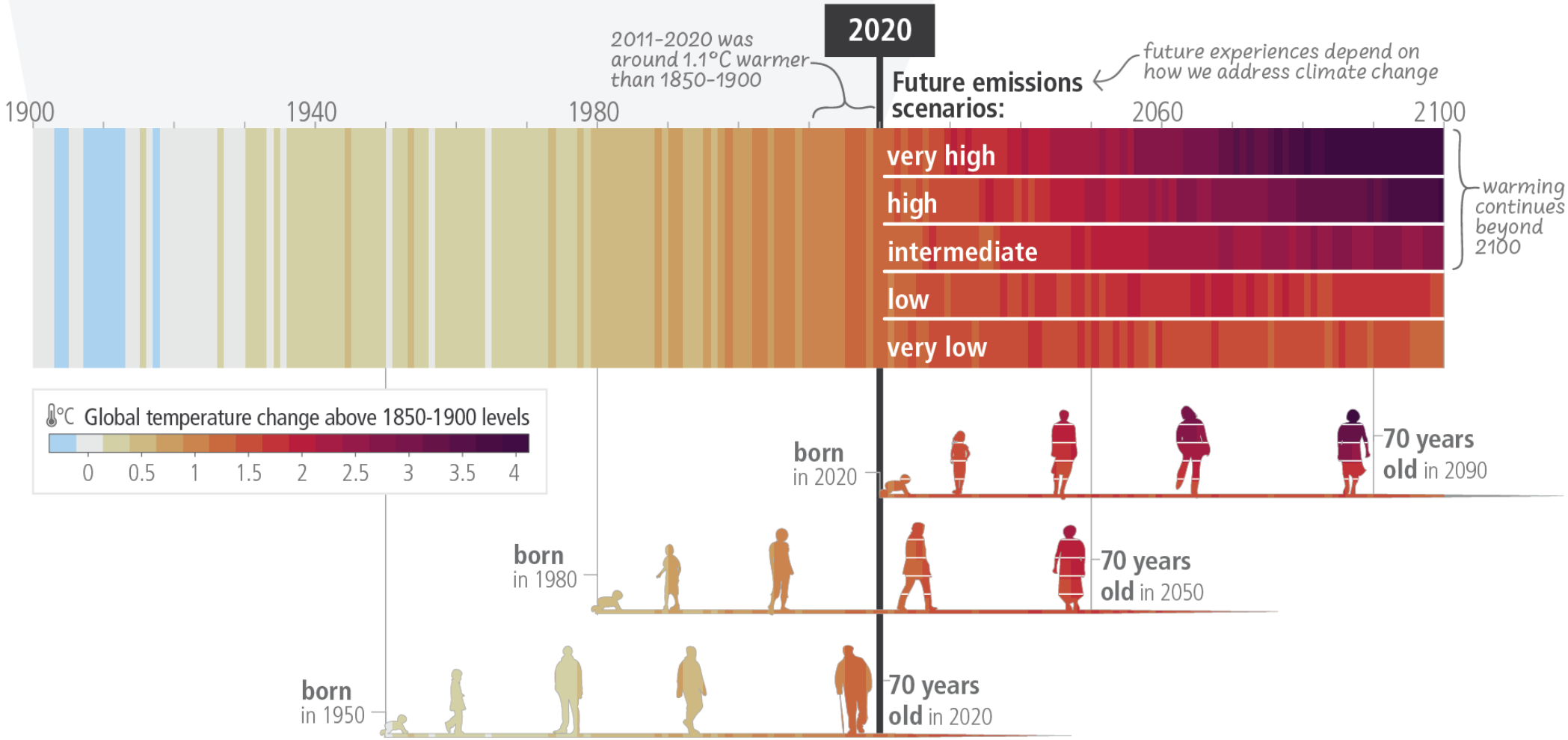
a) Observed widespread and substantial impacts and related losses and damages attributed to climate change



b) Impacts are driven by changes in multiple physical climate conditions, which are increasingly attributed to human influence



c) The extent to which current and future generations will experience a hotter and different world depends on choices now and in the near-term



Categories of climate-change risks to health

Direct effects

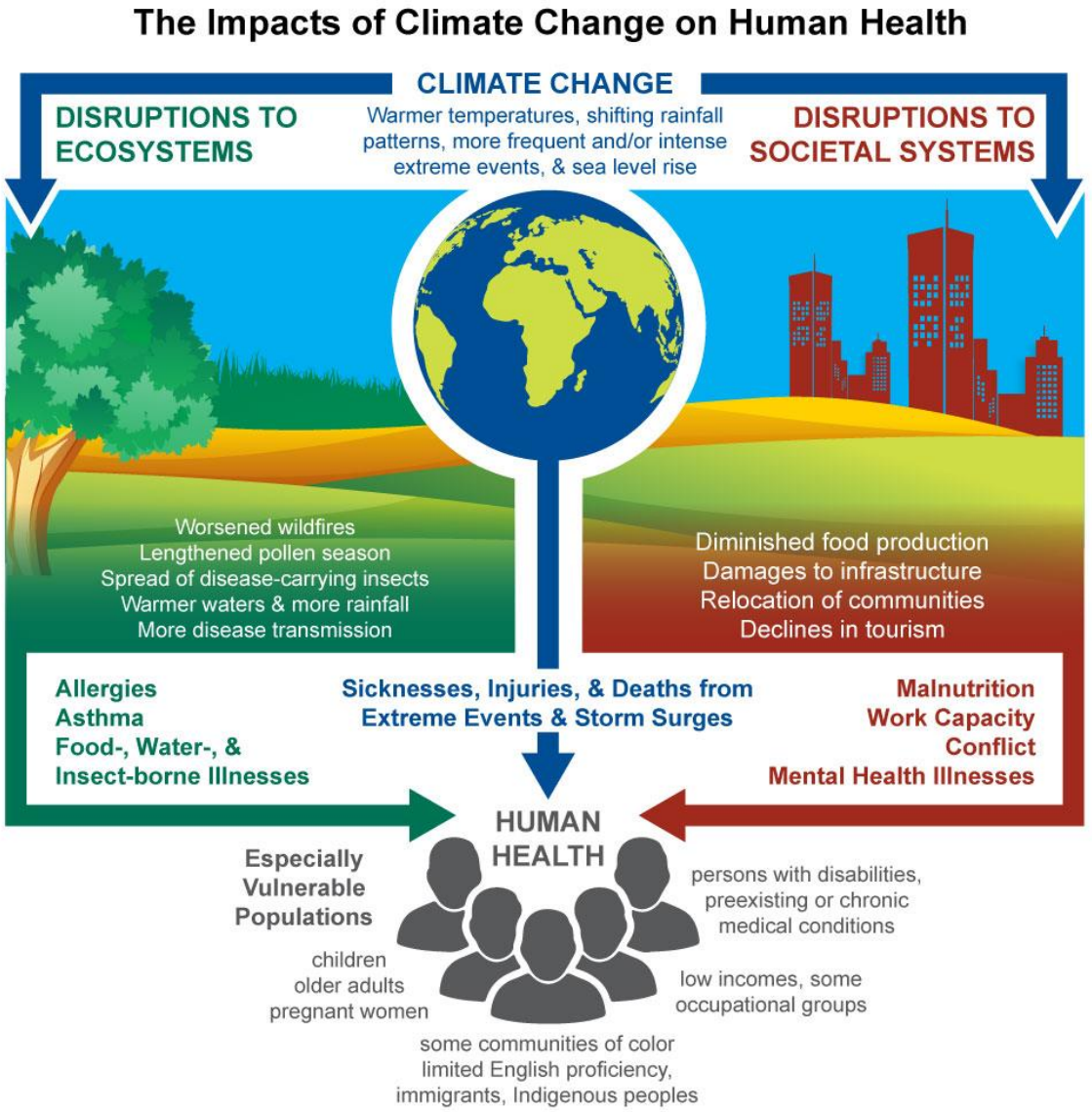
Direct biological consequences.
e.g. heatwaves, extreme weather events, air pollution increase due to temperature

Indirect effects

Risks mediated by changes in biophysically and ecologically based processes and systems, e.g. food security, water security, spread of vector-borne diseases

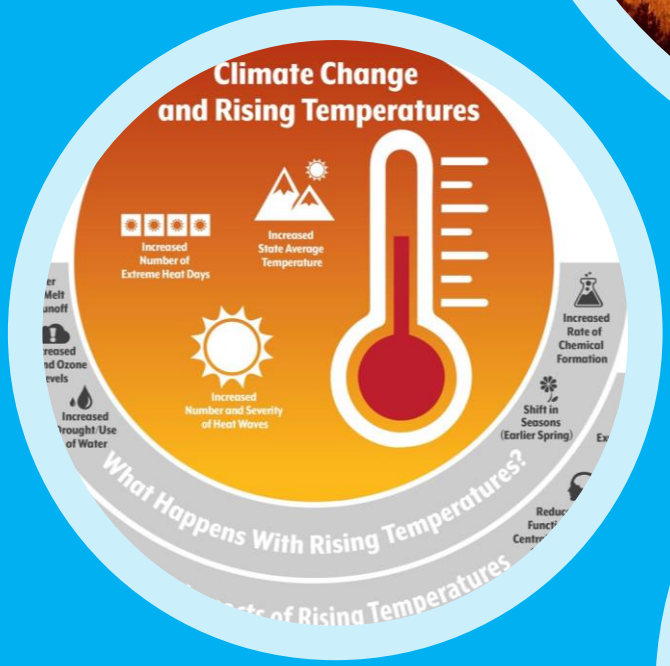
Diffuse effects

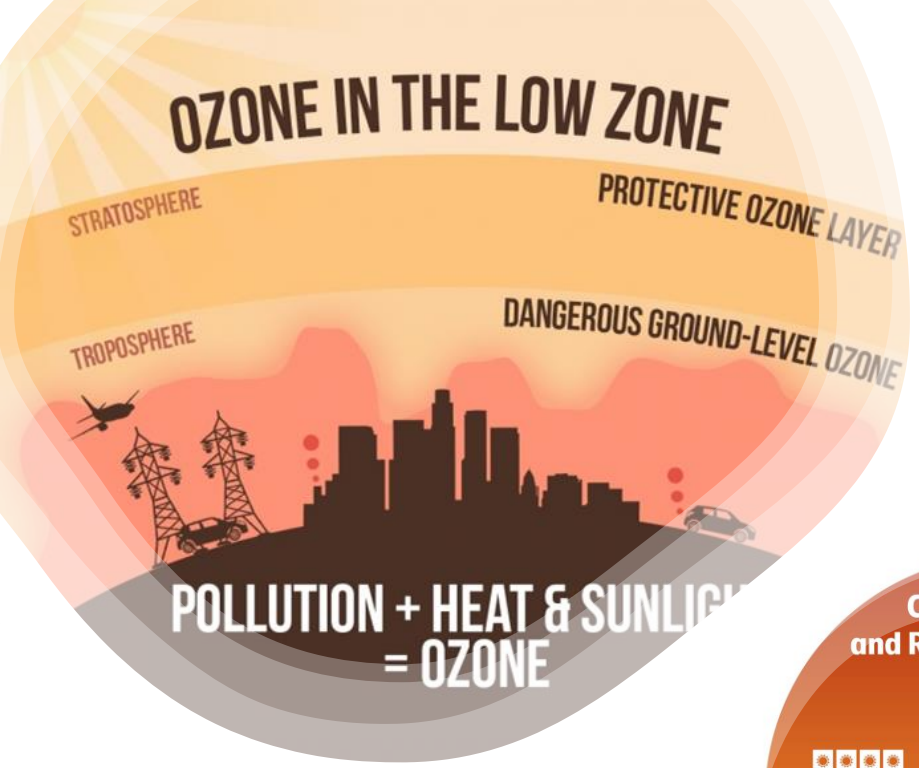
Societal effects due to social and systemic disruption, e.g. mental health effects, tension and conflict over basic resources, migration

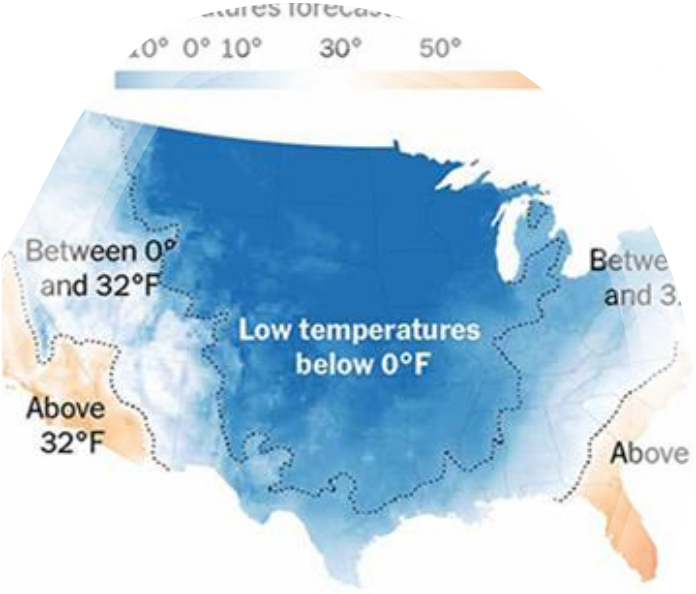


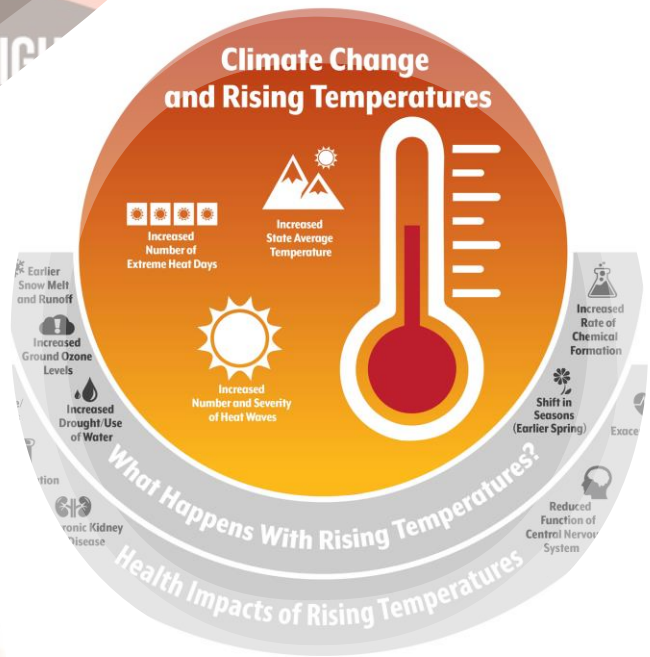
Direct effects

- Air pollution
- Temperature
- Extreme weather events









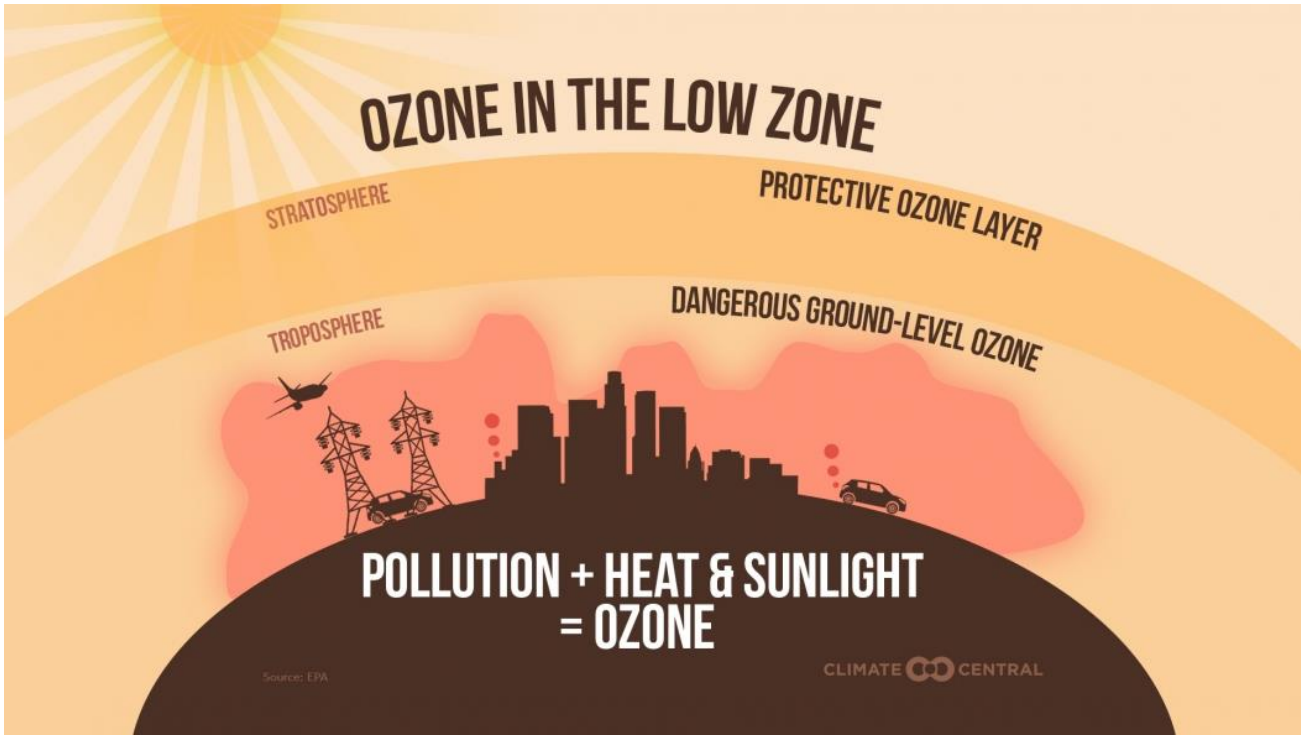
Direct effects

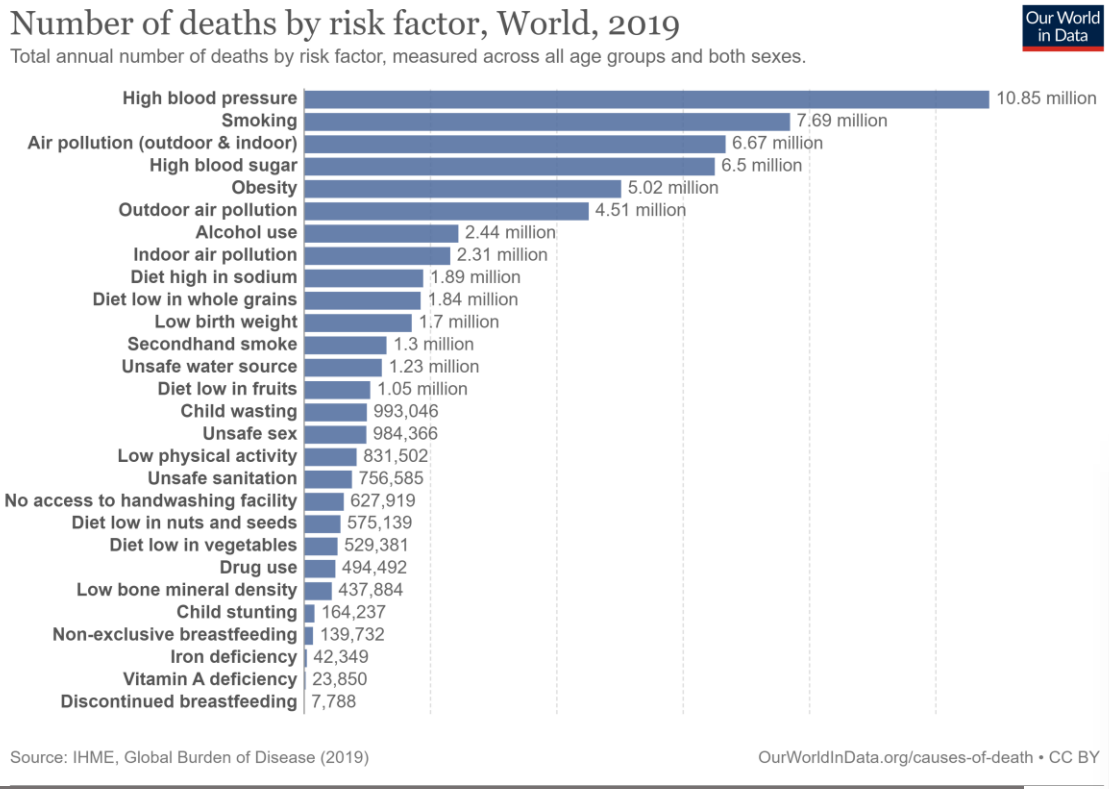
- Rising temperatures
- Temperature-enhanced air pollution
- Extreme weather events
- Prolonged allergen season

Temperature-enhanced Air Pollution

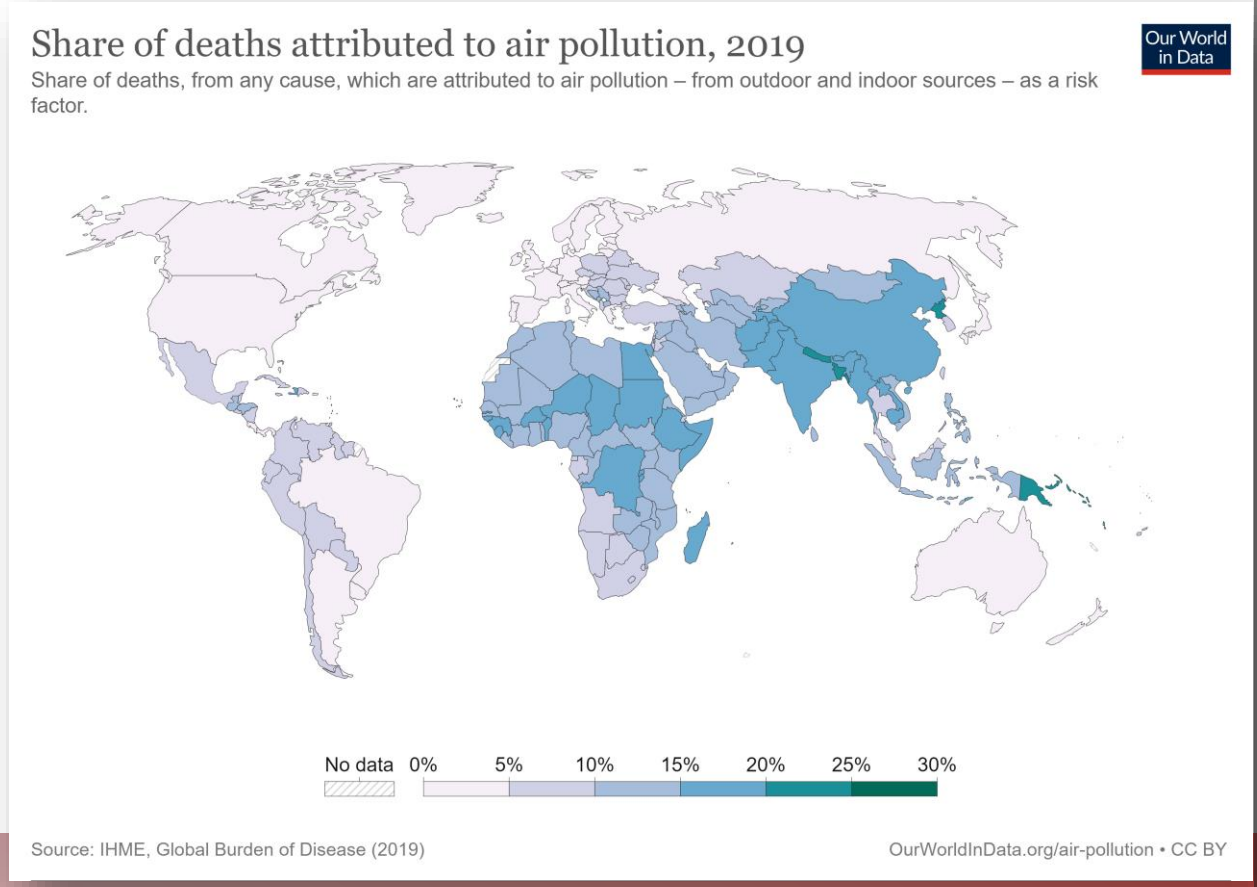
Depending on the level of exposure, ozone can:

- Make it more difficult to breathe deeply and vigorously.
- Cause shortness of breath, and pain when taking a deep breath.
- Cause coughing and sore or scratchy throat.
- Inflame and damage the airways.
- Aggravate lung diseases such as asthma, emphysema, and chronic bronchitis.
- Increase the frequency of asthma attacks.
- Make the lungs more susceptible to infection.

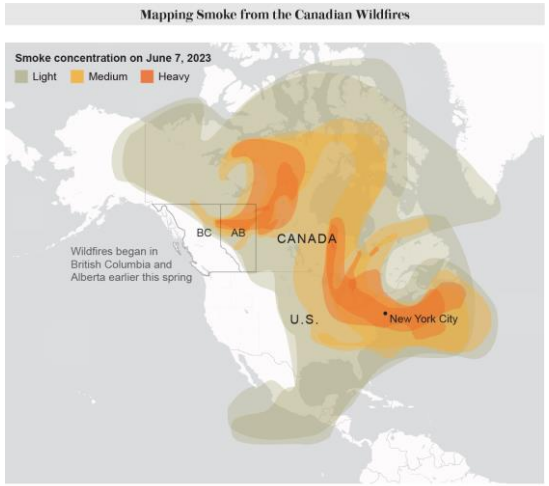




Air pollution contributes to 11.65% of deaths globally (Our World in Data, 2023)



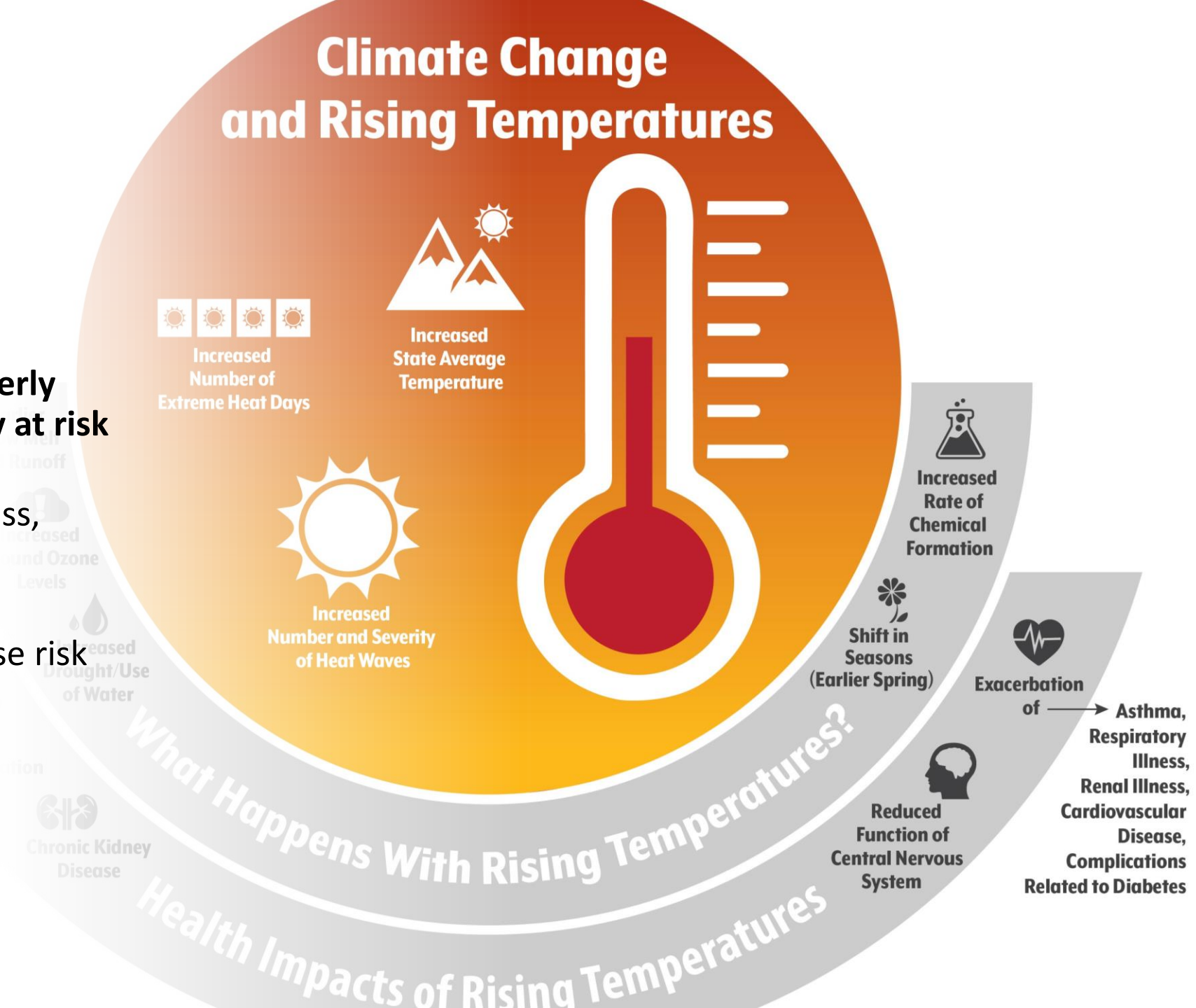
Wildfire Effects



Rising Temperatures

Vulnerable population (elderly and children) are especially at risk

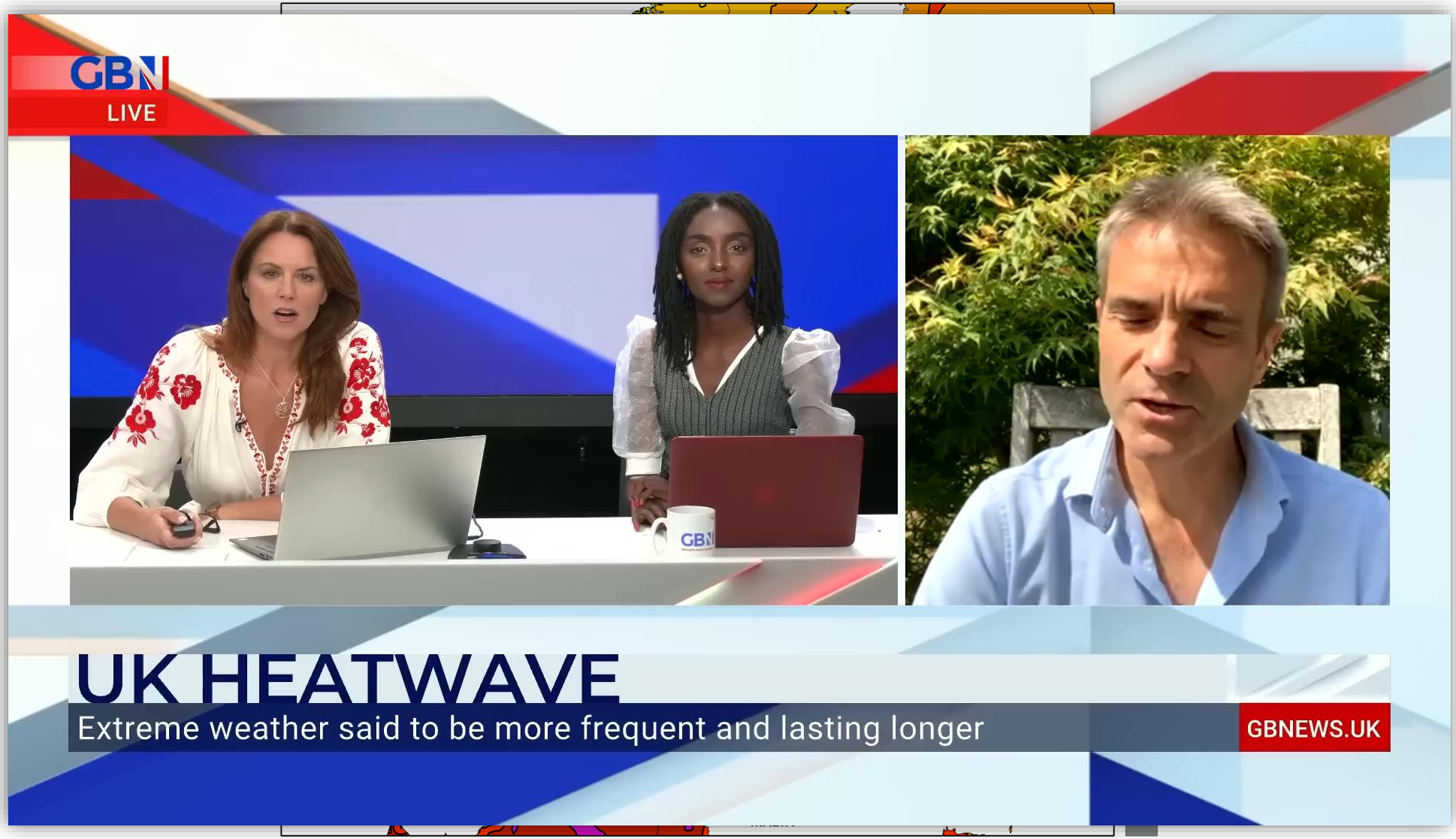
- Discomfort, heat stress, heat stroke
- Dehydration
- Cardiovascular disease risk



EUROPE

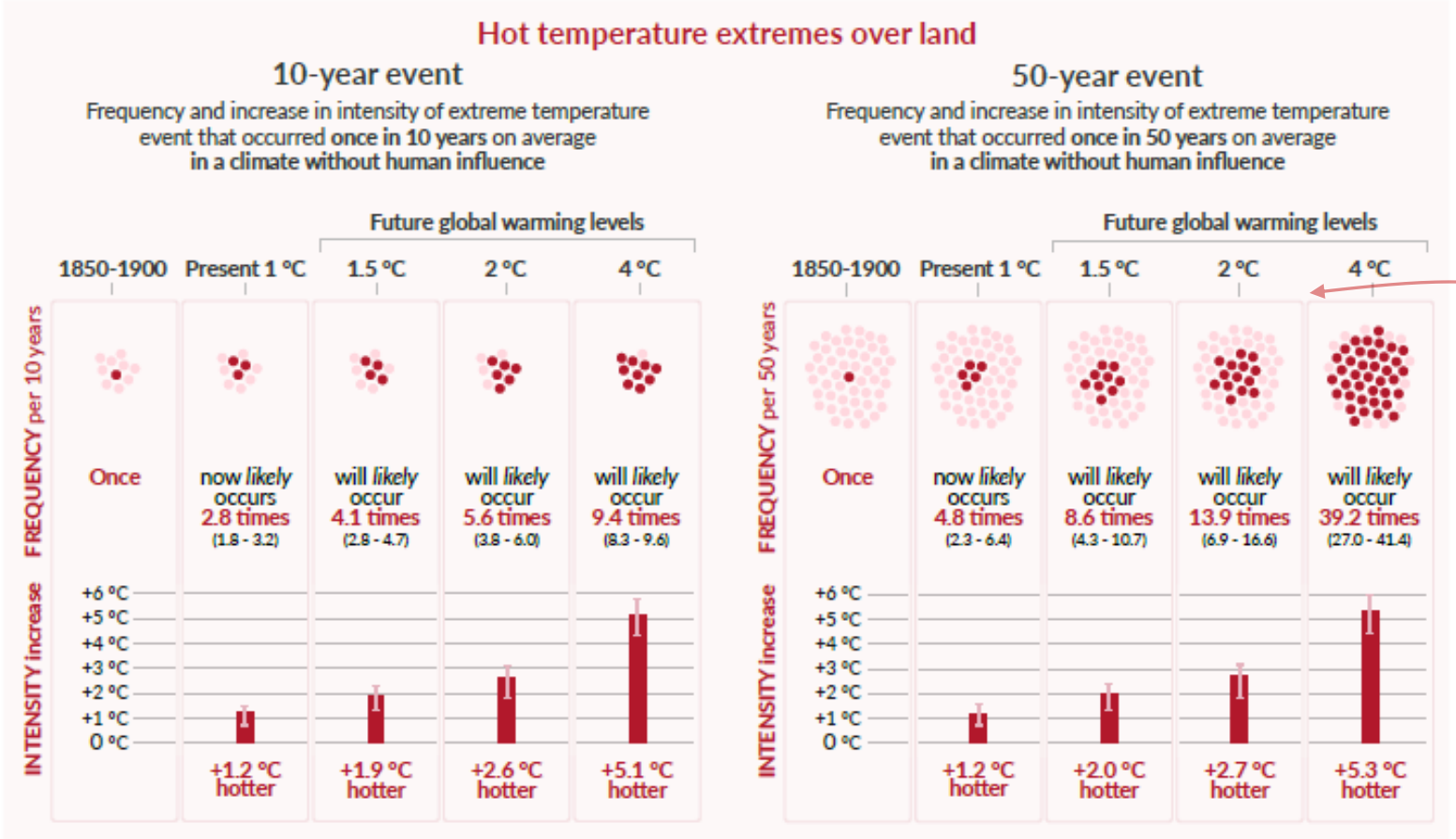
Extreme Maximum Temperature (C)

July 17 - 23, 2022



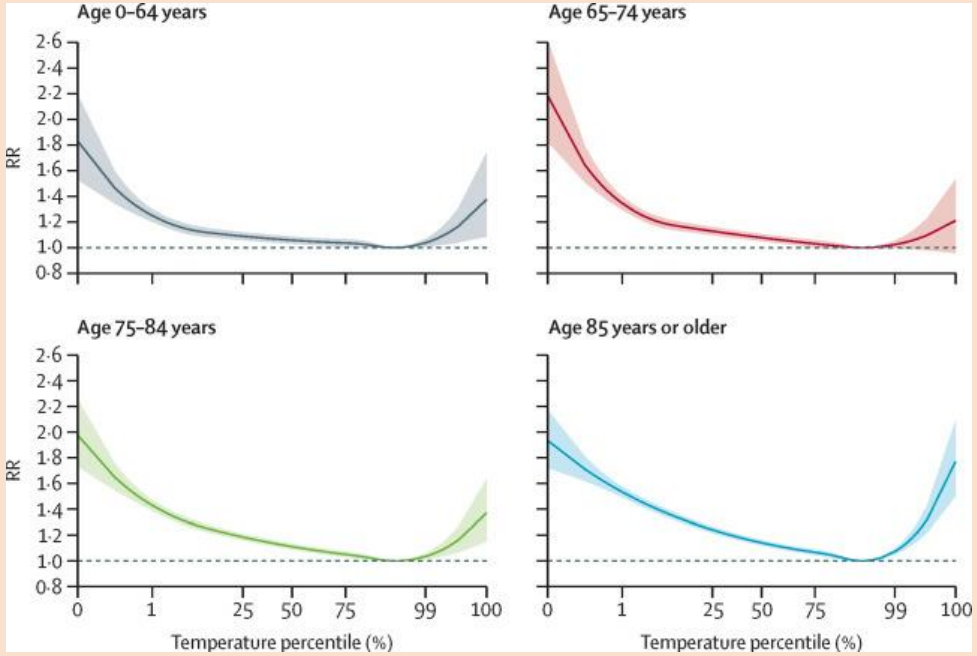
CLIMATE PREDICTION CENTER, NOAA
Computer generated contours
Based on preliminary data

Projected changes in extremes are larger in frequency and intensity with every additional increment of global warming



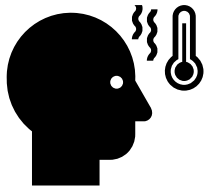
Where we're heading >3˚C…

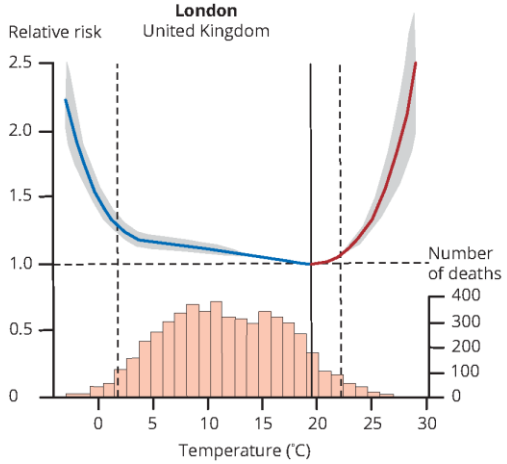
…14 – 40 times increased frequency of a 50-year event. Once every two years

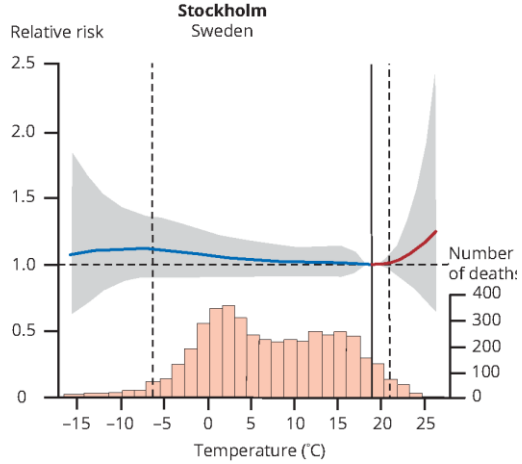


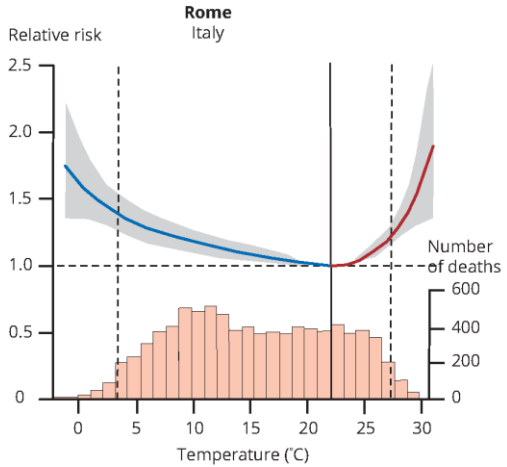
England recorded 2,800 excess deaths in over-65s during 2022 heatwaves

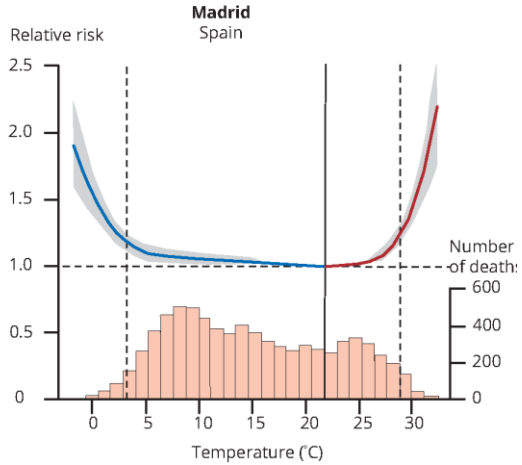
Calls for government to take action now to prevent further unnecessary deaths next summer

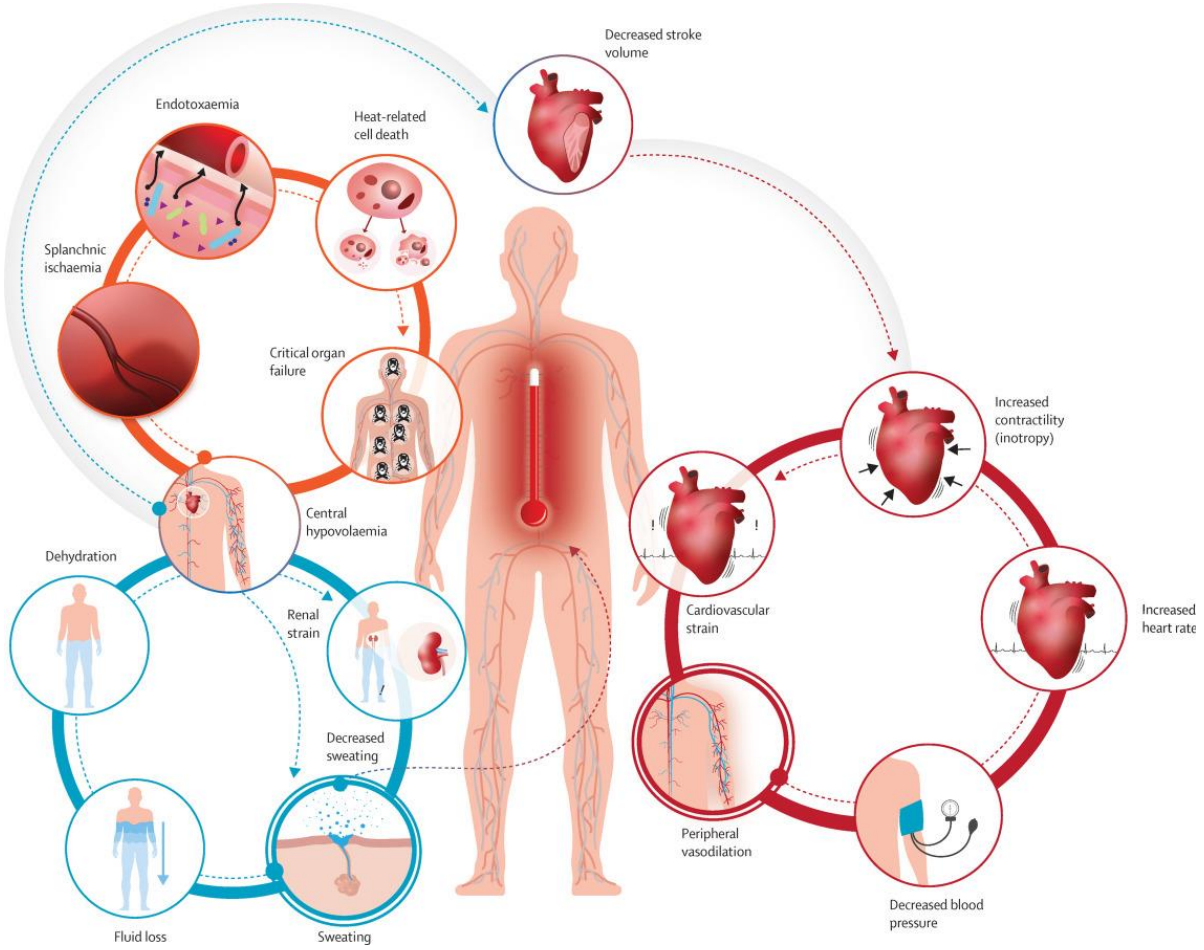




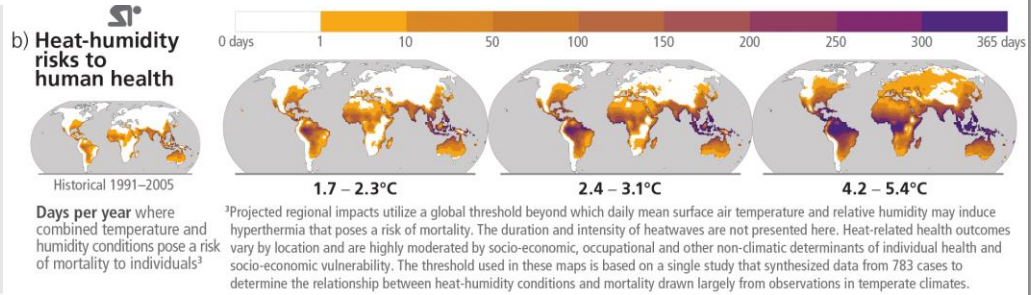








"Climate change is interacting with other trends, such as population growth and ageing, urbanisation, and socioeconomic development, that can either exacerbate or ameliorate heat-related hazards. Urban temperatures are further enhanced by anthropogenic heat from vehicular transport and heat waste from buildings."



"Although there is some evidence of adaptation to increasing temperatures in high-income countries, projections of a hotter future suggest that without investment in research and risk management actions, heat-related morbidity and mortality are likely to increase."

Wet Bulb Temperature

- Defined as the temperature read by a thermometer covered in a water-soaked cloth over which air is passed,

- At 100% relative humidity, the wet-bulb temperature is equal to the air temperature (dry-bulb temperature). At a lower humidity, the wet-bulb temperature is lower as there is evaporative cooling (humidity gradient). The drier the air, the faster the water will evaporate, the faster the cooling (= lower temperature)

Wet Bulb Temperature

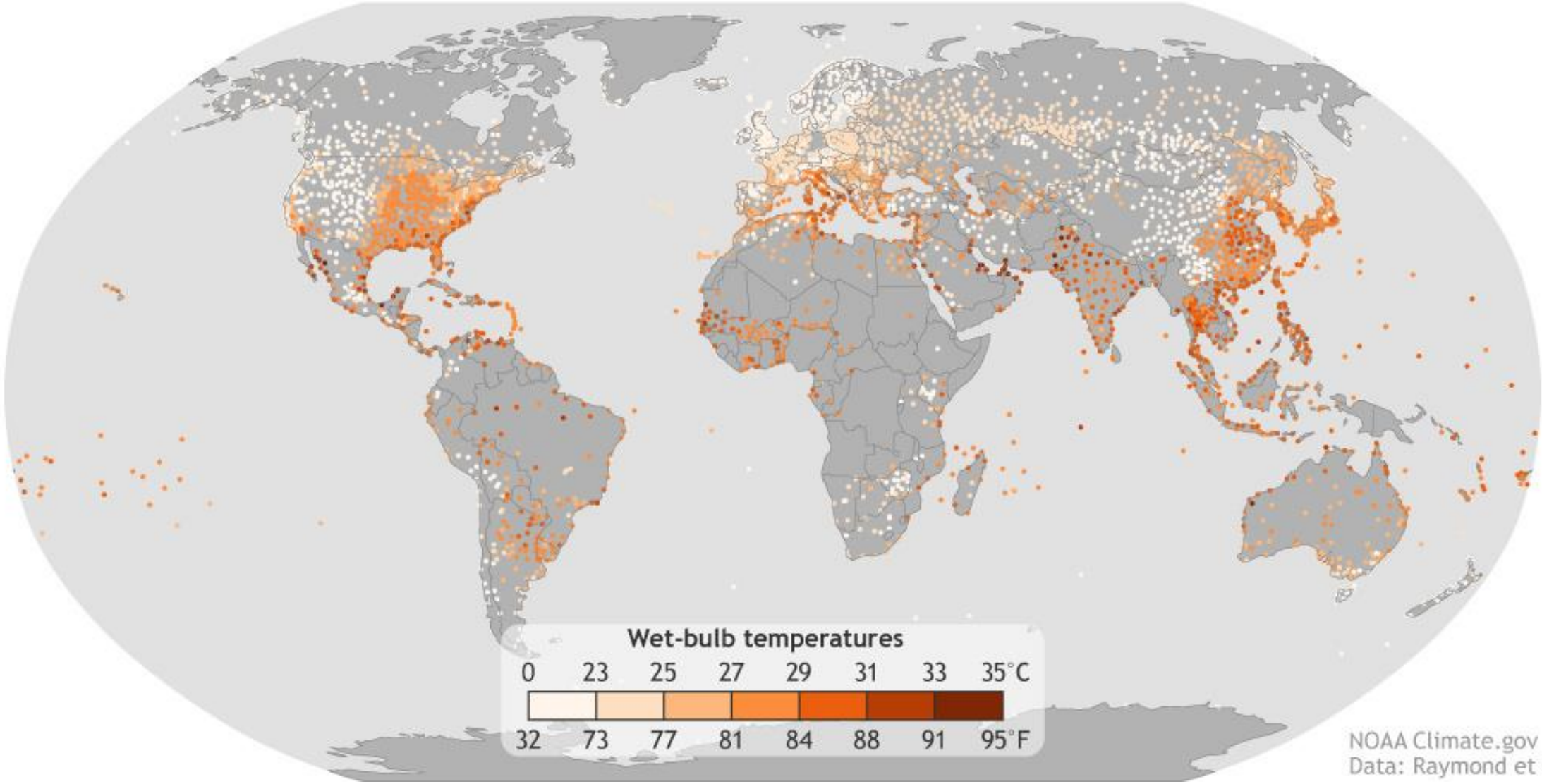
Heat Stress Category (WBGT)	Moderate Work		Hard Work	
	Work/Rest Cycle	Water Intake Per Hour	Work/Rest Cycle	Water Intake Per Hour
White ≤76.9°F (≤24.9°C)	60/15 MINUTES	300 ml (1/3 qt)	40/20 MINUTES	500 ml (1/2 qt)
Green 77-81.9°F (25-27.7°C)	60/15 MINUTES	750 ml (3/4 qt)	40/20 MINUTES	1000 ml (1 qt)
Yellow 82-84.9°F (27.8-29.4°C)	40/20 MINUTES	1000 ml (1 qt)	30/30 MINUTES	1000 ml (1 qt)
Red 85-88.9°F (29.5-31.6°C)	30/30 MINUTES	1000 ml (1 qt)	**Exercise is forbidden. Very high risk for heat casualties.**	
Black ≥89°F (≥31.7°C)	**Exercise is forbidden. Very high risk for heat casualties.**			

Metrication of Template:HeatTable

Relative Humidity (%)	temperature (°C)																
	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43
40	27	28	29	30	31	32	34	35	37	39	41	43	46	48	51	54	57
45	27	28	29	30	32	33	35	37	39	41	43	46	49	51	54	57	
50	27	28	30	31	33	34	36	38	41	43	46	49	52	55	58		
55	28	29	30	32	34	36	38	40	43	46	48	52	55	59			
60	28	29	31	33	35	37	40	42	45	48	51	55	59				
65	28	30	32	34	36	39	41	44	48	51	55	59					
70	29	31	33	35	38	40	43	47	50	54	58						
75	29	31	34	36	39	42	46	49	53	58							
80	30	32	35	38	41	44	48	52	57								
85	30	33	36	39	43	47	51	55									
90	31	34	37	41	45	49	54										
95	31	35	38	42	47	51	57										
100	32	36	40	44	49	54											

- Caution
- Extreme Caution
- Danger
- Extreme Danger

TOP 0.1% OF HOT AND HUMID DAYS (1979–2017)



NOAA Climate.gov
Data: Raymond et al., 2020

High Temperature implications

- Climate change can have knock-on effects, many of which we may not necessarily think of (e.g. heat – drought – poor cooling – power cuts – heatstroke – overwhelmed systems)

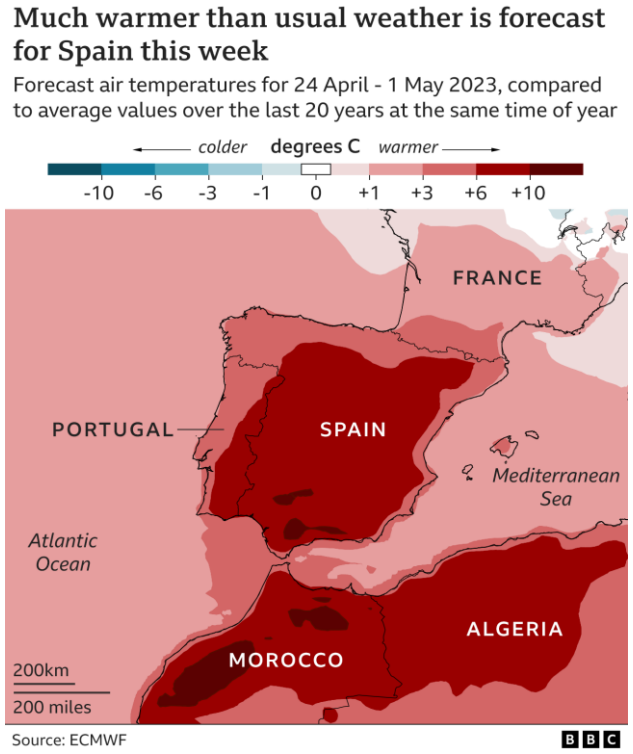
- Question to ask – as the world warms and the UK enters a warmer climate regimen, do you think UK housing on average is adapted to extreme heat?

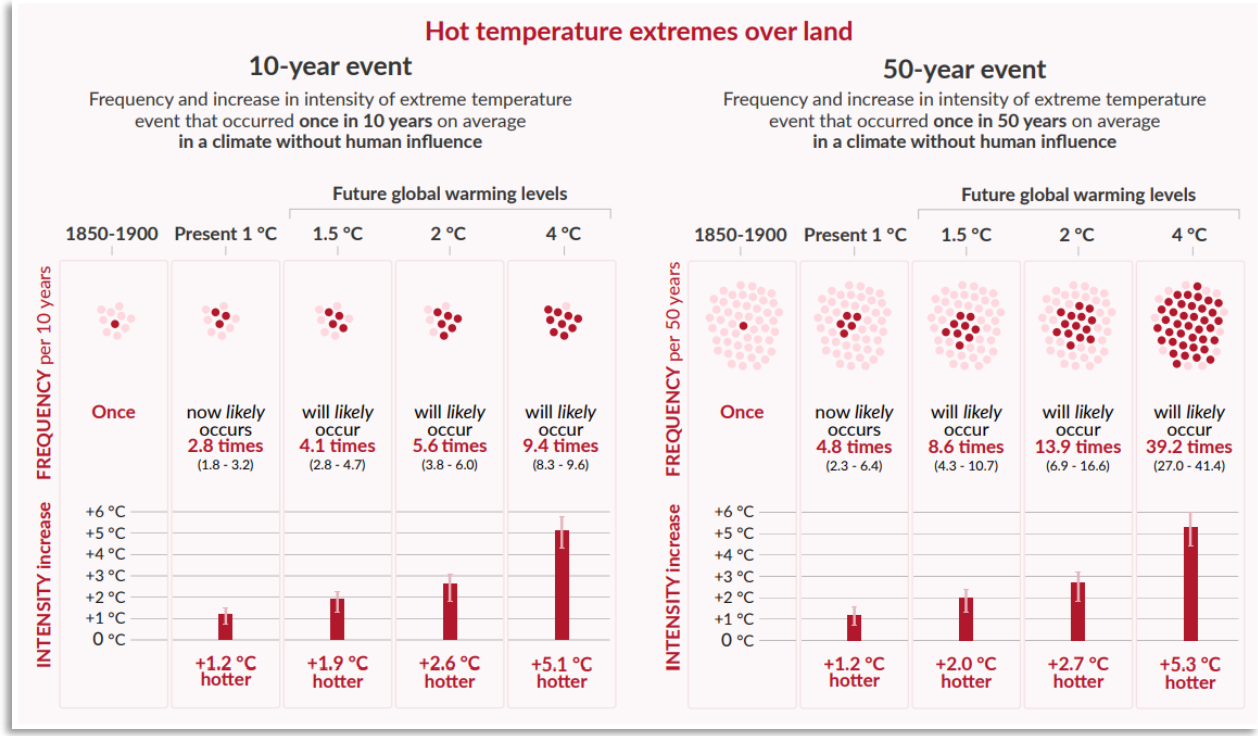
- This is just one example. There are other knock-on effects – on food, farming, disease, which we will look into.

Tier 1: Direct effects : **Extremes**

April 2023

- Record temperature in Spain for April
- Temperature anomalies of >10°C above normal reached in Granada



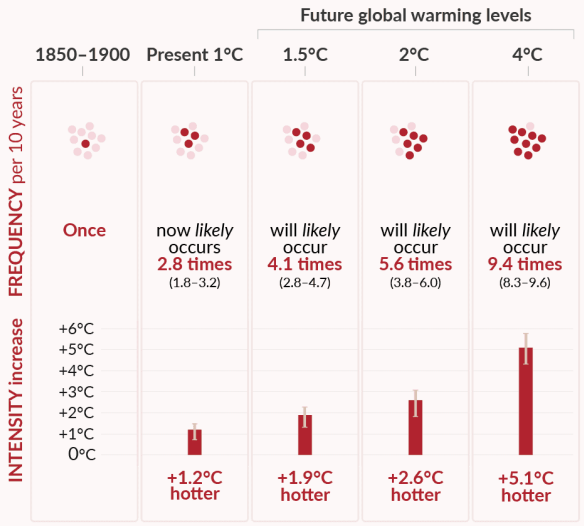


Climate change is already affecting every inhabited region across the globe, with human influence contributing to many observed changes in weather and climate extremes

Hot temperature extremes over land

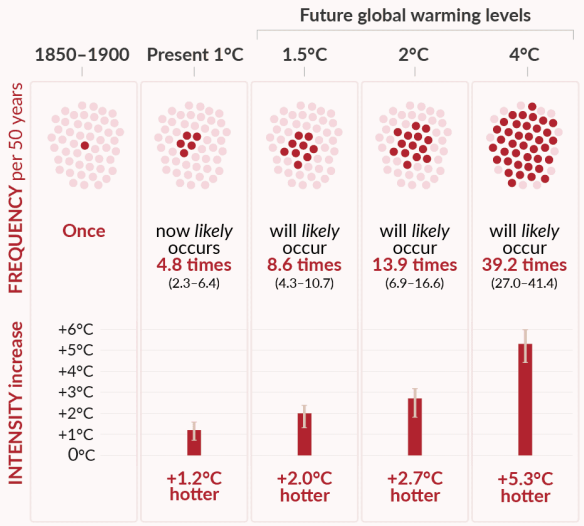
10-year event

Frequency and increase in intensity of extreme temperature event that occurred **once in 10 years** on average **in a climate without human influence**



50-year event

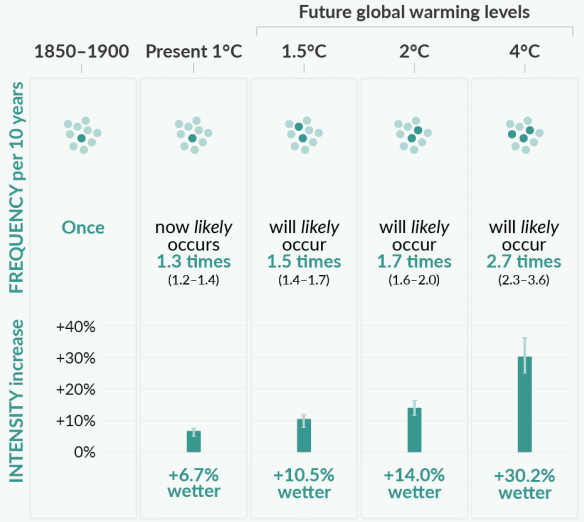
Frequency and increase in intensity of extreme temperature event that occurred **once in 50 years** on average **in a climate without human influence**



Heavy precipitation over land

10-year event

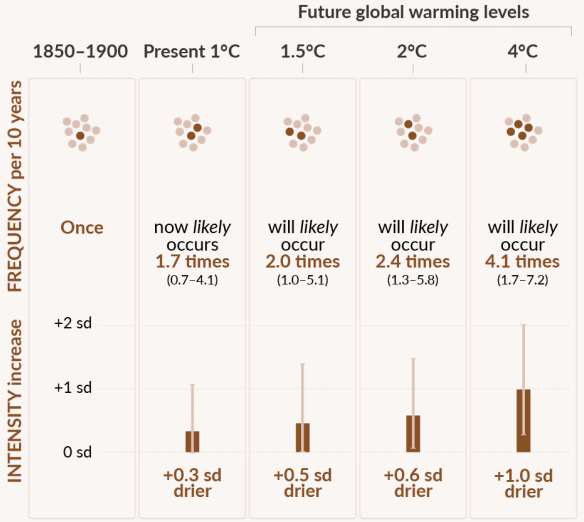
Frequency and increase in intensity of heavy 1-day precipitation event that occurred **once in 10 years** on average **in a climate without human influence**



Agricultural & ecological droughts in drying regions

10-year event

Frequency and increase in intensity of an agricultural and ecological drought event that occurred **once in 10 years** on average **across drying regions in a climate without human influence**



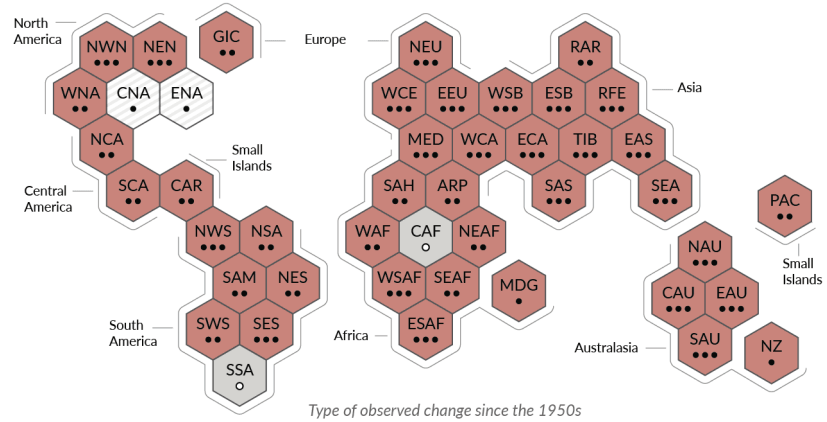
(a) Synthesis of assessment of observed change in **hot extremes** and confidence in human contribution to the observed changes in the world's regions

Type of observed change
in hot extremes

- Increase (41)
- Decrease (0)
- Low agreement in the type of change (2)
- Limited data and/or literature (2)

Confidence in human contribution
to the observed change

- ●●● High
- ●● Medium
- ● Low due to limited agreement
- ○ Low due to limited evidence



Type of observed change since the 1950s

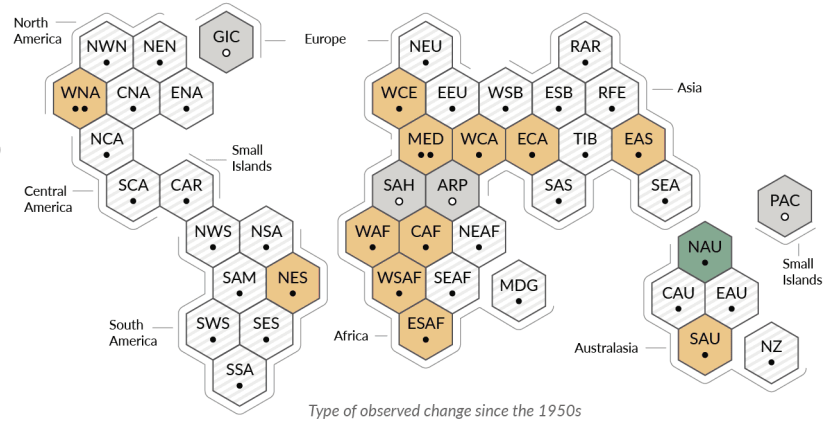
(c) Synthesis of assessment of observed change in **agricultural and ecological drought** and confidence in human contribution to the observed changes in the world's regions

Type of observed change
in agricultural and ecological drought

- Increase (12)
- Decrease (1)
- Low agreement in the type of change (28)
- Limited data and/or literature (4)

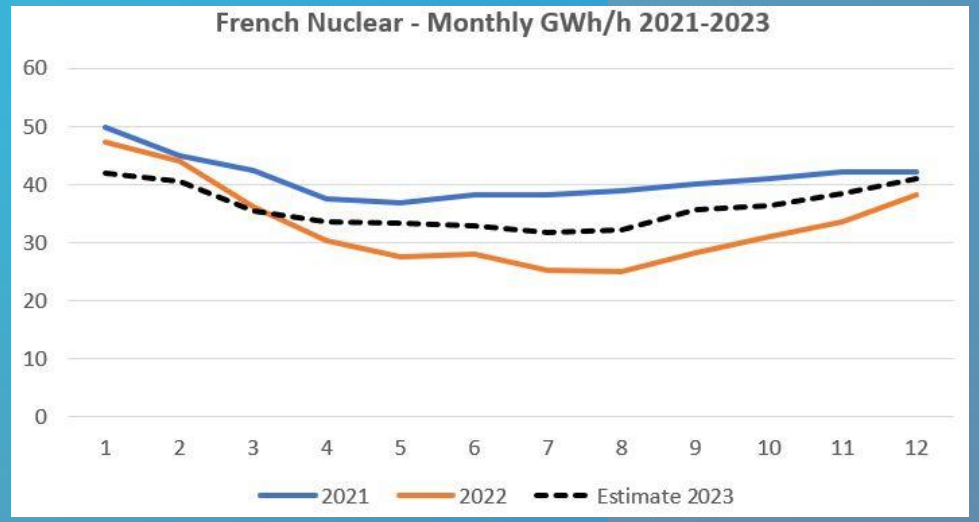
Confidence in human contribution
to the observed change

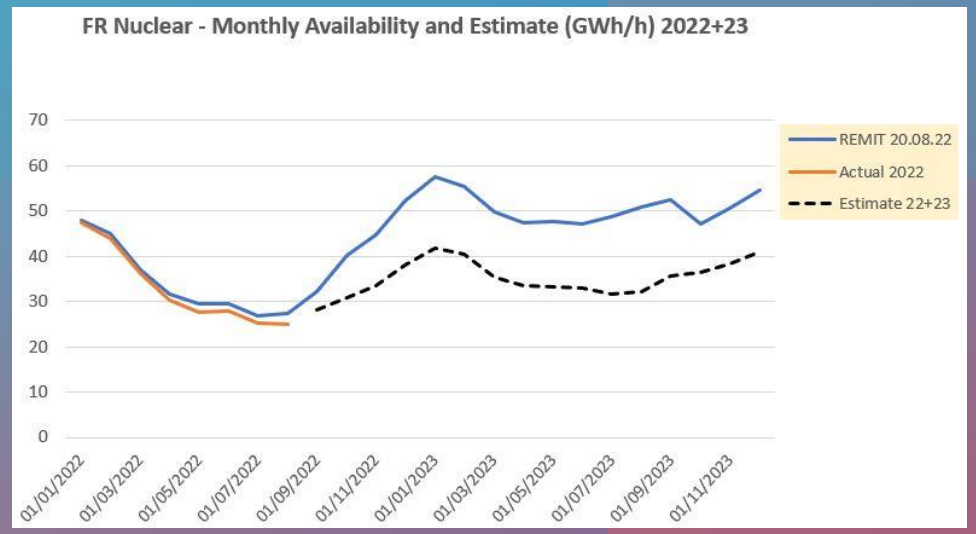
- ●●● High
- ●● Medium
- ● Low due to limited agreement
- ○ Low due to limited evidence



Type of observed change since the 1950s

High Temperature implications: the unexpected





ENVIRONMENT

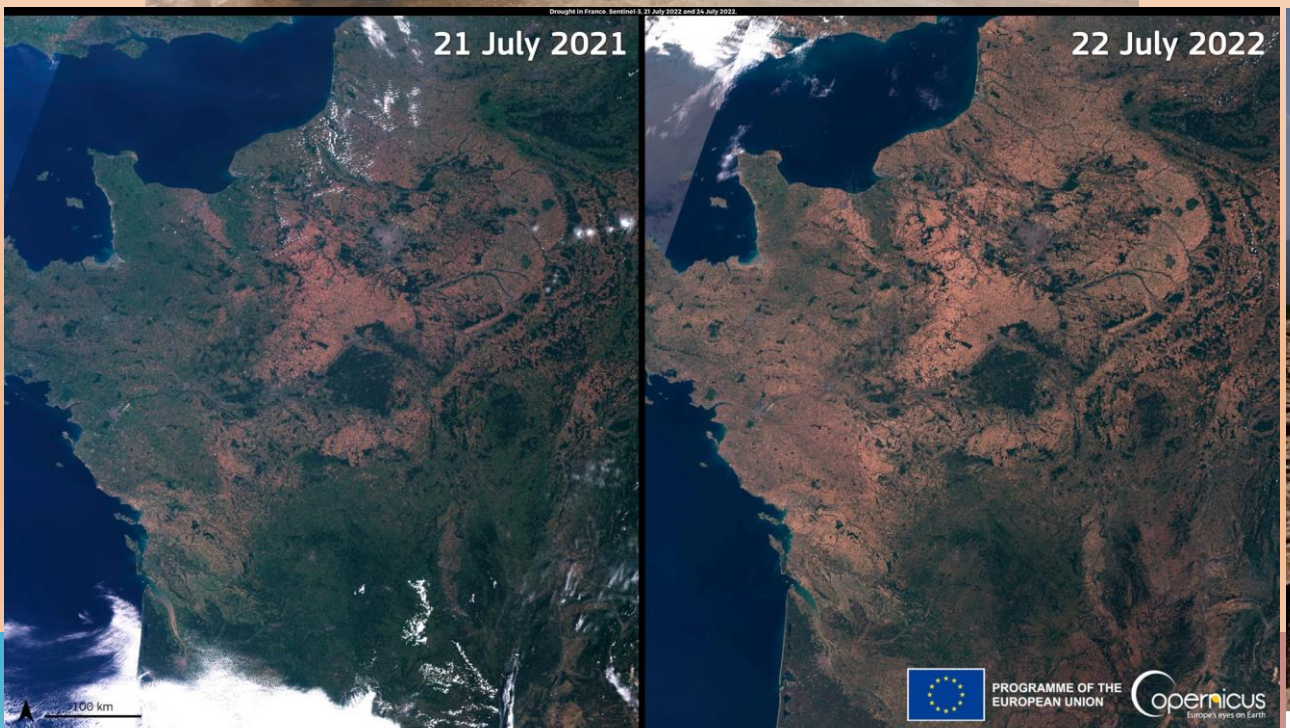
France authorities shut down nuclear reactors due to drought

The French government has shut down two nuclear reactors after weeks of drought made the cooling process too difficult to manage.

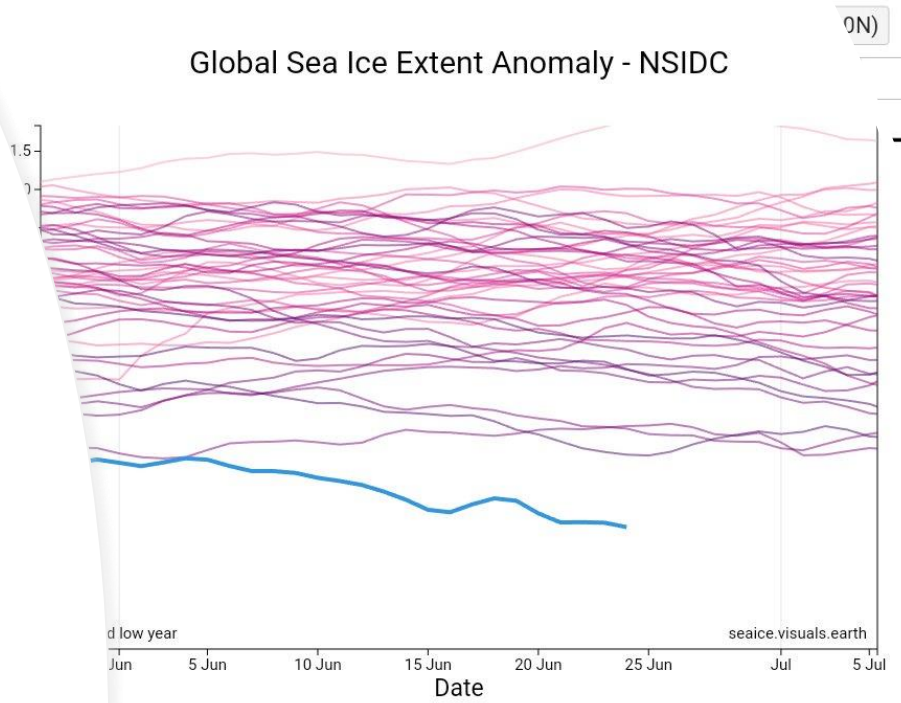
Published: 25 August 2020 11:05 CEST

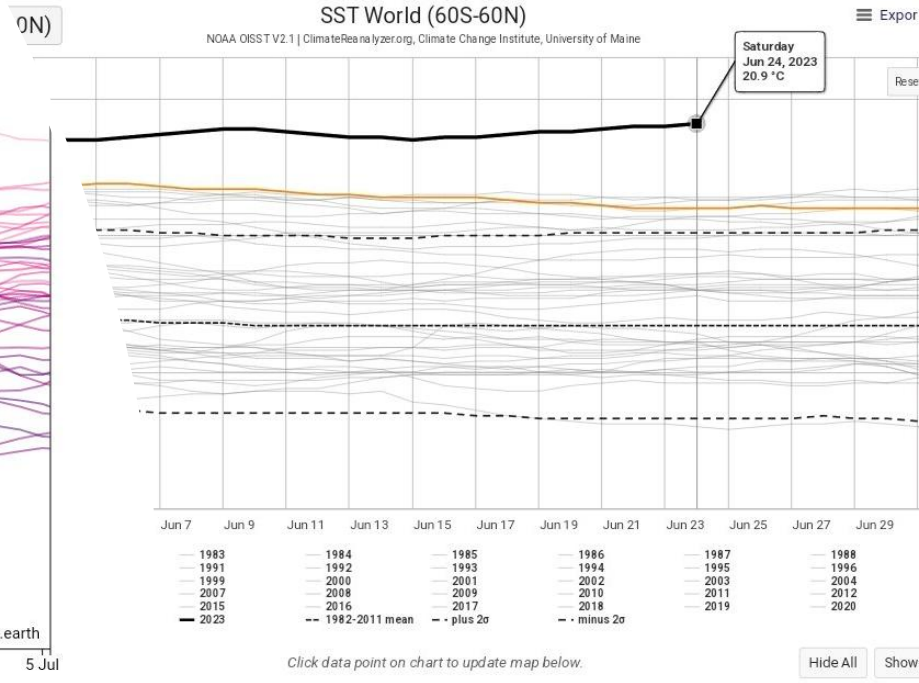
Loire River, France, 2022

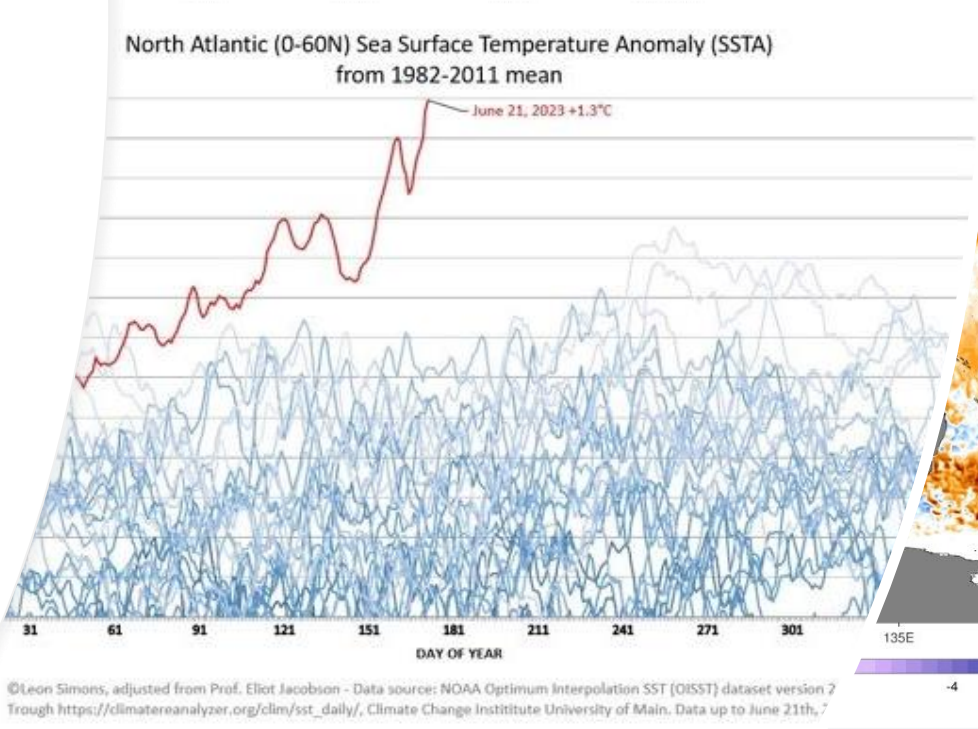
Jialing River, China, 2022

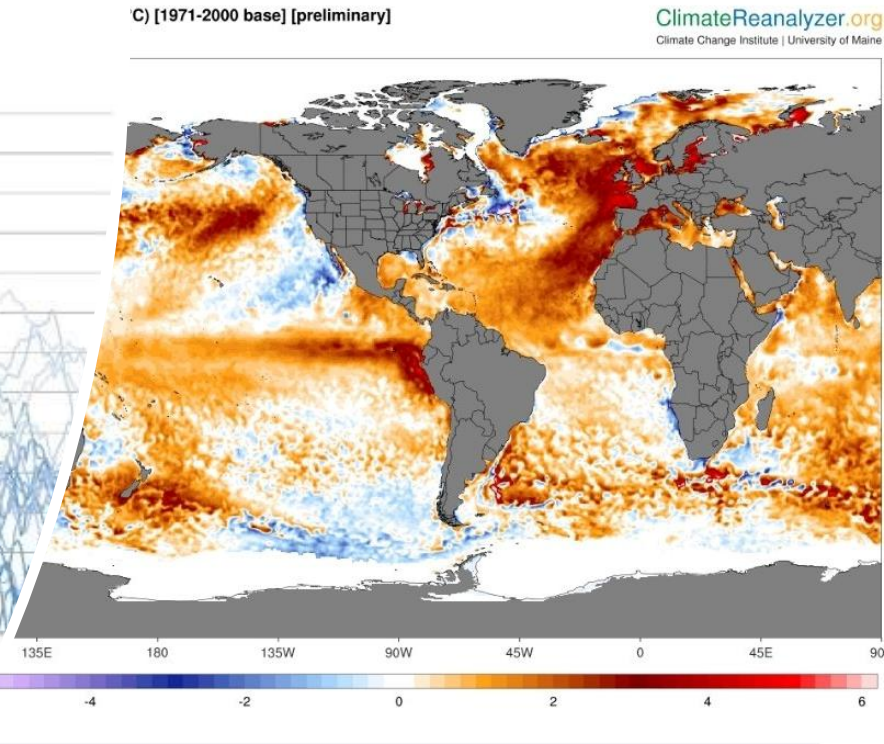


2023 – Temperatures off the charts





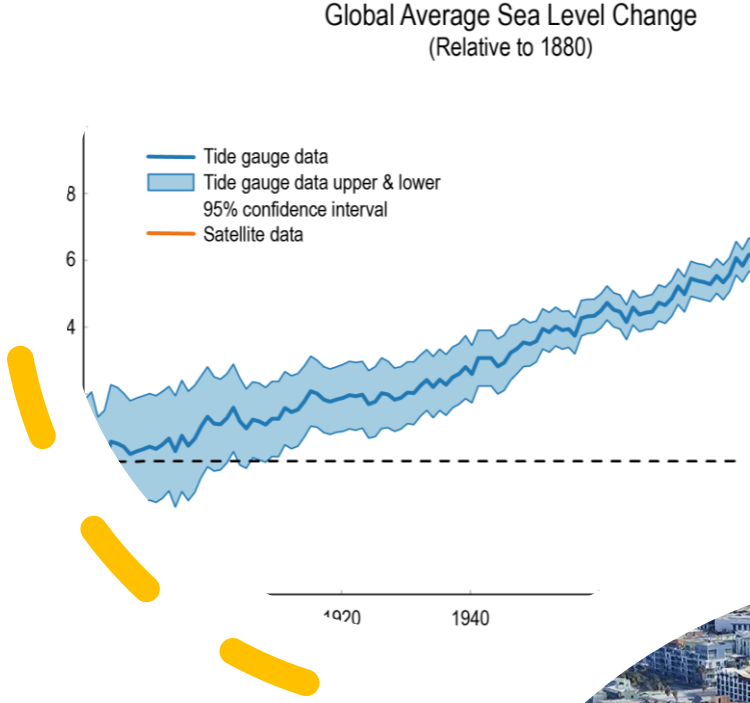




Sea-Level rise

Direct effects of sea-level rise include incremental risks that may go beyond infrastructure-capacity threshold

E.g. Rising seas lead to an increased risk of storm surges that flood low-lying areas



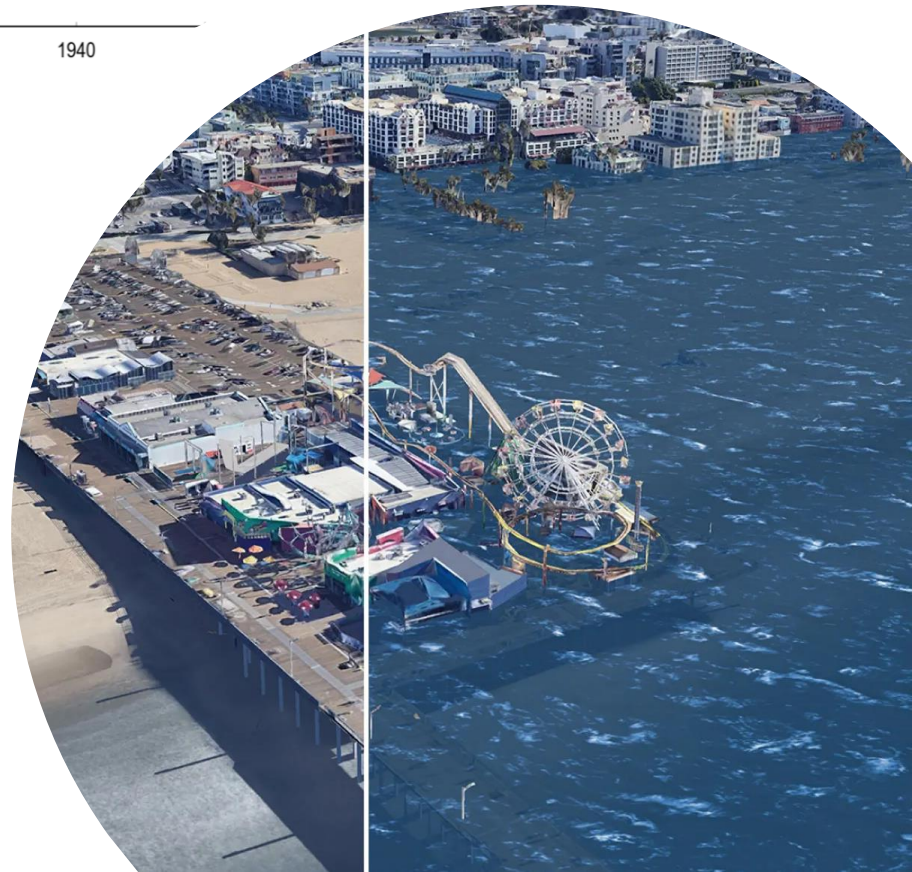
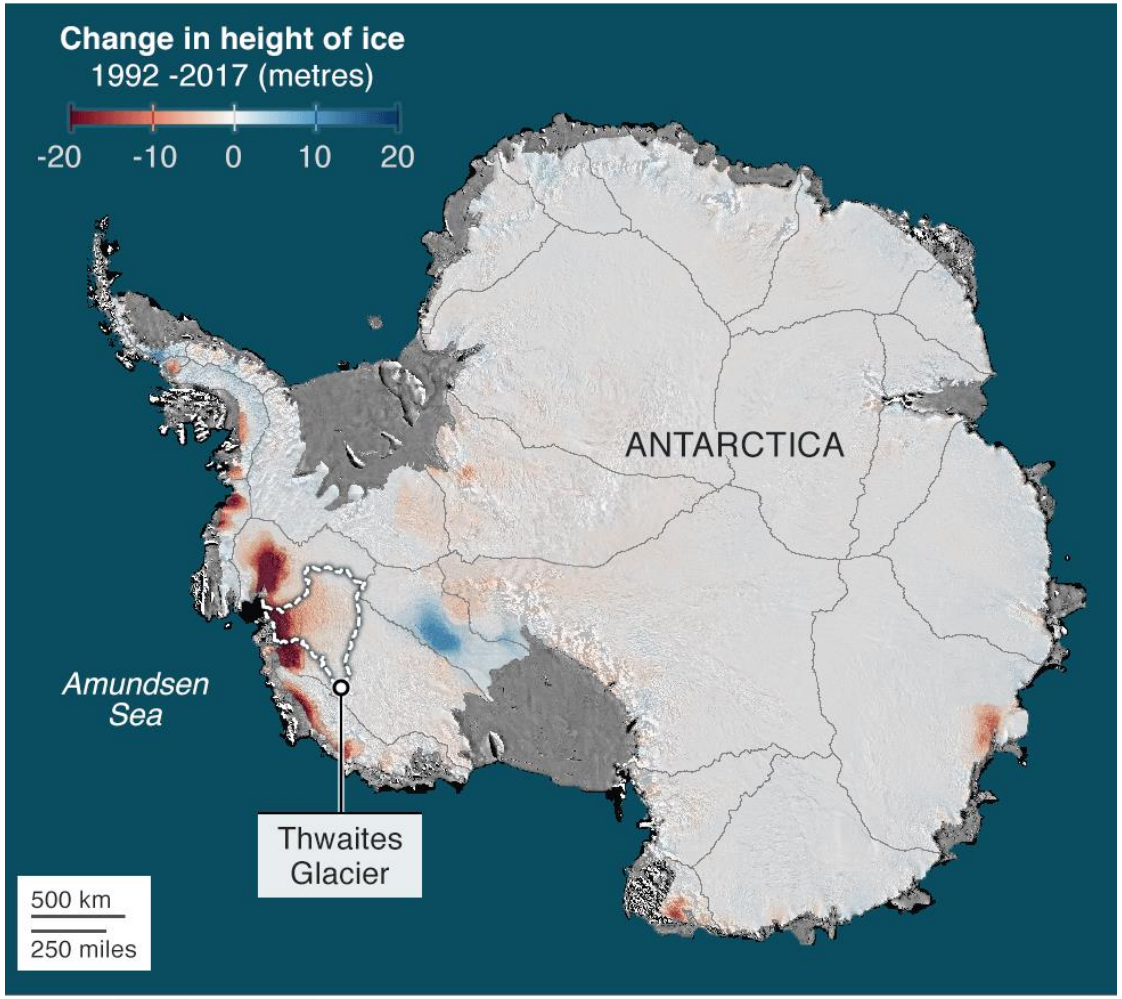


Image Source: The Guardian(2021)

Ice sheets in West Antarctica have thinned the most



Source: Tom Slater, CPOM

BBC

2 minute read · April 21, 2023 6:06 PM GMT+2 · Last Updated 12 days ago

Pace of rise in global sea level has doubled, UN climate report says

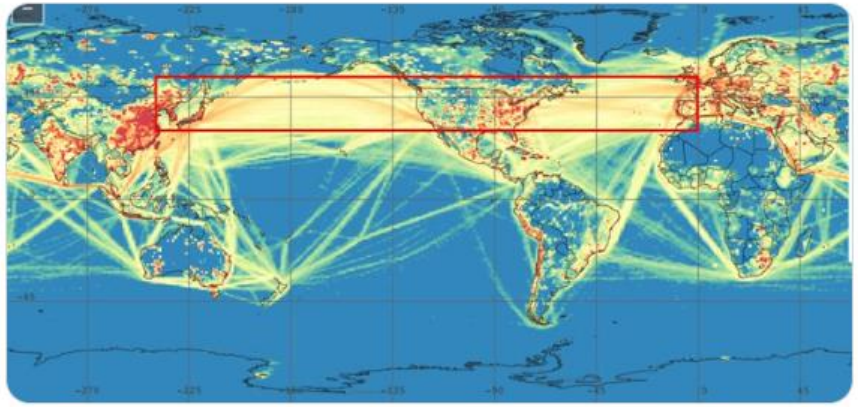
By Emma Farge

[1/2] The remains of houses are pictured as rising sea levels destroy homes built along the shoreline, forcing villagers to relocate, in El Bosque, Mexico, November 7, 2022. REUTERS/Gustavo Gra **Read More**

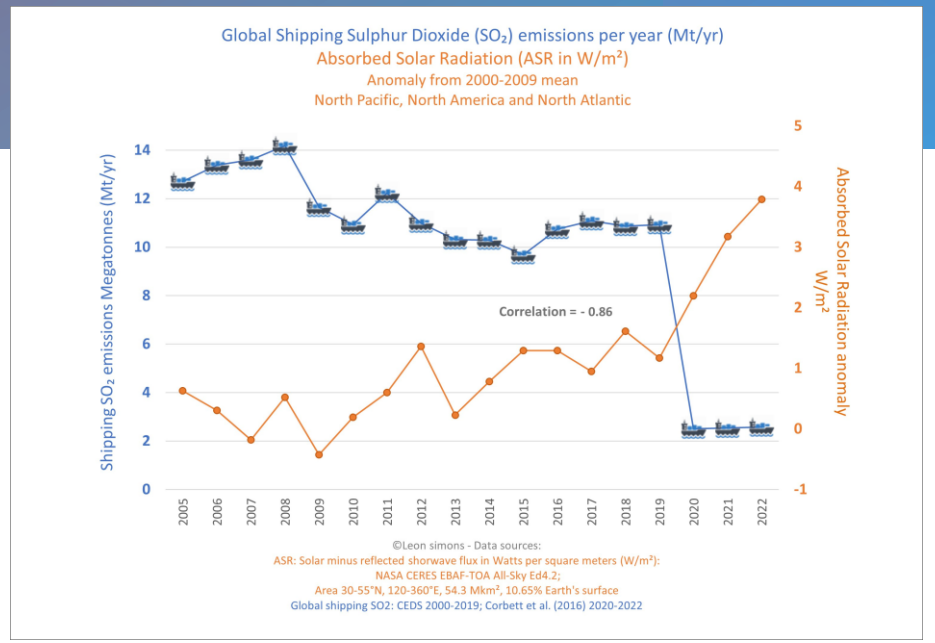
Knock-on effects of global change

For decades this area has been kept relatively cool by sulfur emissions from ships.

But this changed in 2020.



9:33 PM · Mar 8, 2023 · **2.2M** Views



As sulphur emissions plummeted since 2020 (a good thing!), so has the cooling effects of sulphur aerosols (ouch!). Consequently, the ‘masks are off’ with climate warming. This might explain the temperatures rising in ways we have not seen before.

Allergens

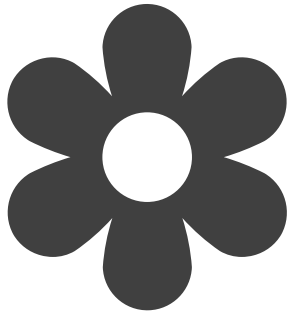
Prolonged allergen season

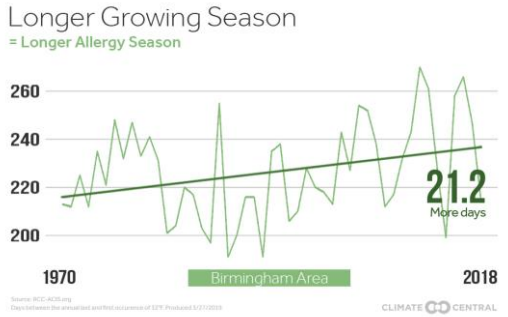
Longer/earlier growing seasons

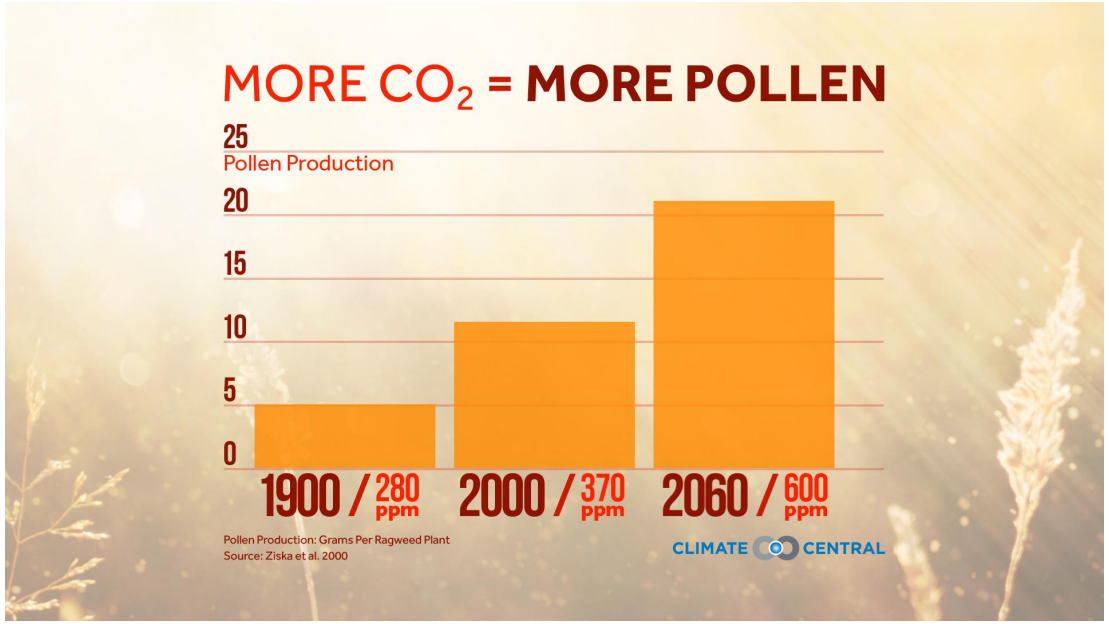
= more pollen

= more allergens

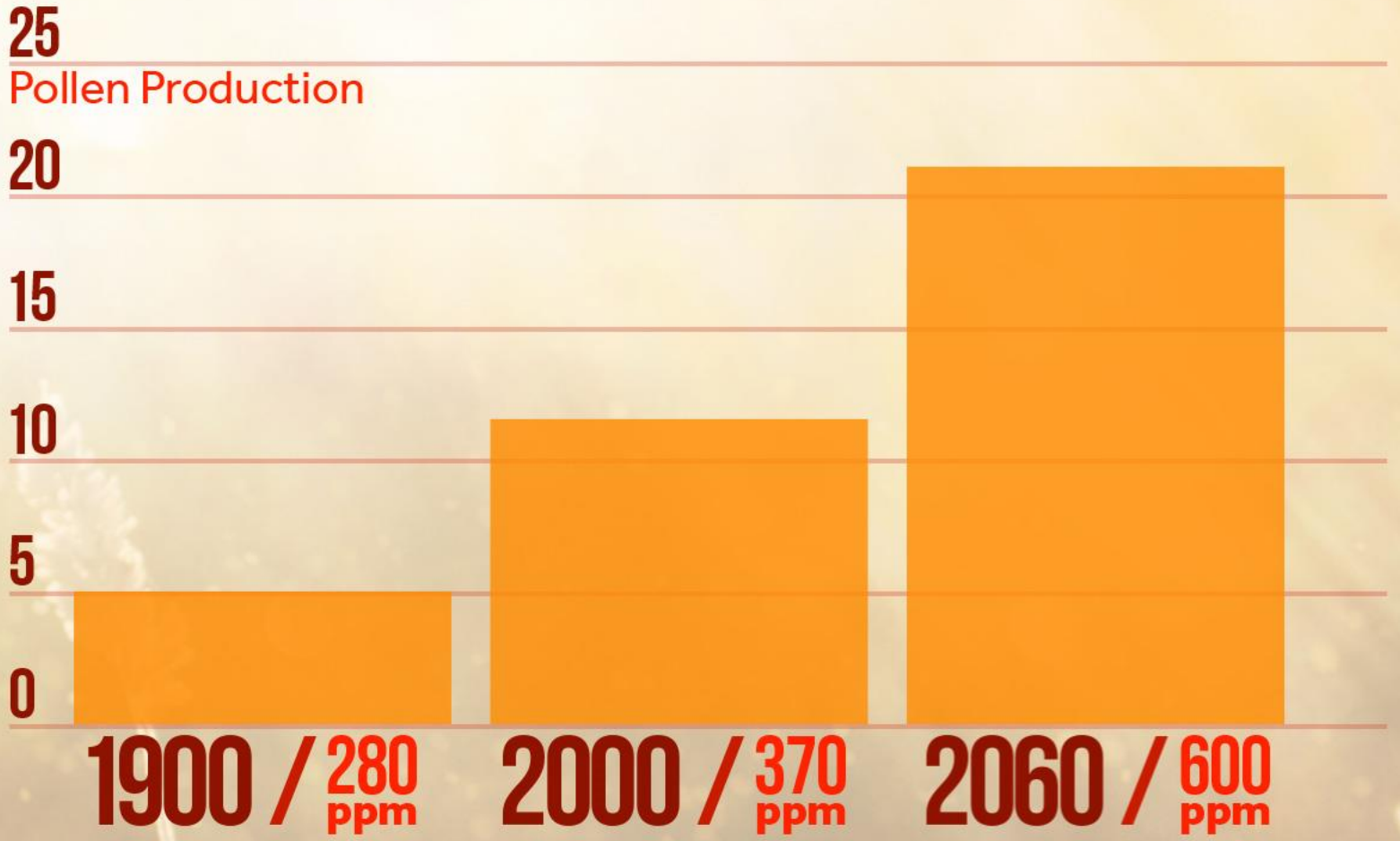
This not only increases discomfort but can cause severe threats to respiratory health, especially for asthmatics, etc.







MORE CO_2 = MORE POLLEN



Pollen Production: Grams Per Ragweed Plant
Source: Ziska et al. 2000

CLIMATE CENTRAL

Waves driven by strong gusts of wind hit the coast of Malta. Sunday, Feb. 24, 2019. (AP Photo/Rene Rossignaud)

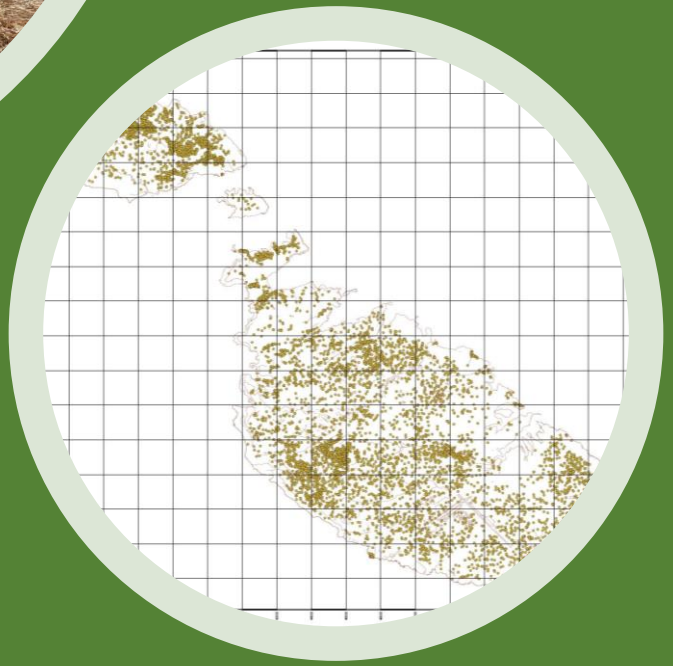
Extreme weather events

People, infrastructure – everyone is at risk from these events

- Disruption of community life
- Destruction of infrastructure
- Risk to health
- Damage to health infrastructure

QUESTIONS TO REFLECT ON

- How will extreme heat affect our communities? Think of your immediate community, your city, and your country.
- With added stresses on our infrastructure and communities, what are the health implications of added discomfort and direct danger to health?

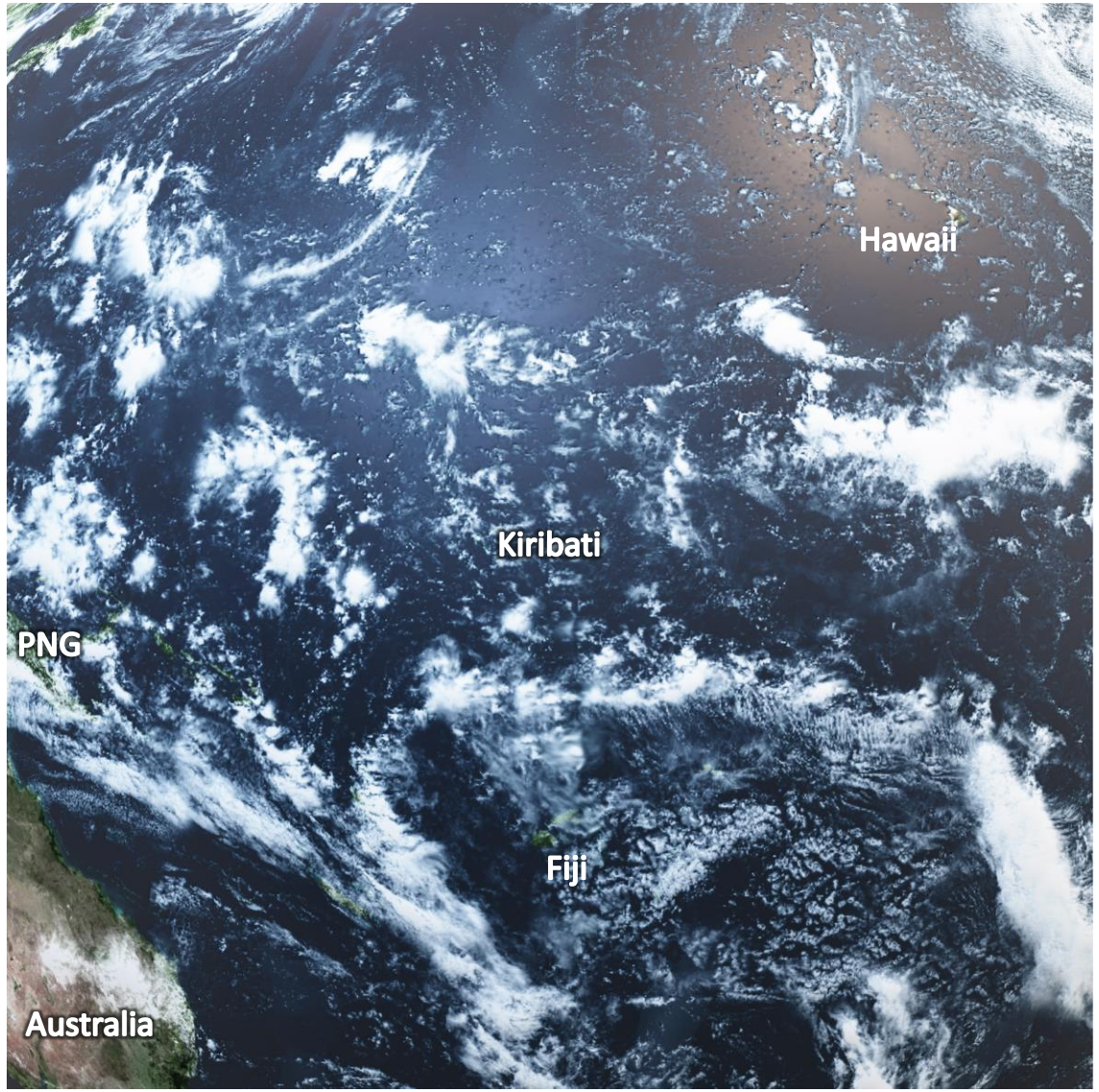


Indirect effects

- Food security
- Water security
- Vector-borne diseases

The Pacific

- Vast region encompassing apx. 1/3rd of the Earth's surface.
- Characterised by my small island nations (barring PNG)



The Pacific

- Vast region encompassing apx. 1/3rd of the Earth's surface.
- Characterised by my small island nations (barring PNG)
- Islands roughly come in two main types.

Volcanic islands

Atolls

Kiribati

- 32 coral atolls & 1 raised atoll
- Population: ~120,000
- Roughly half population live on one atoll: South Tarawa
- Independent since 1979
- Official languages: I-Kiribati, English
- Classified as a ‘Least Developed Country’ by the UN

Atolls

- Gilbert islands
- Phoenix islands
- Line islands

Kiribati

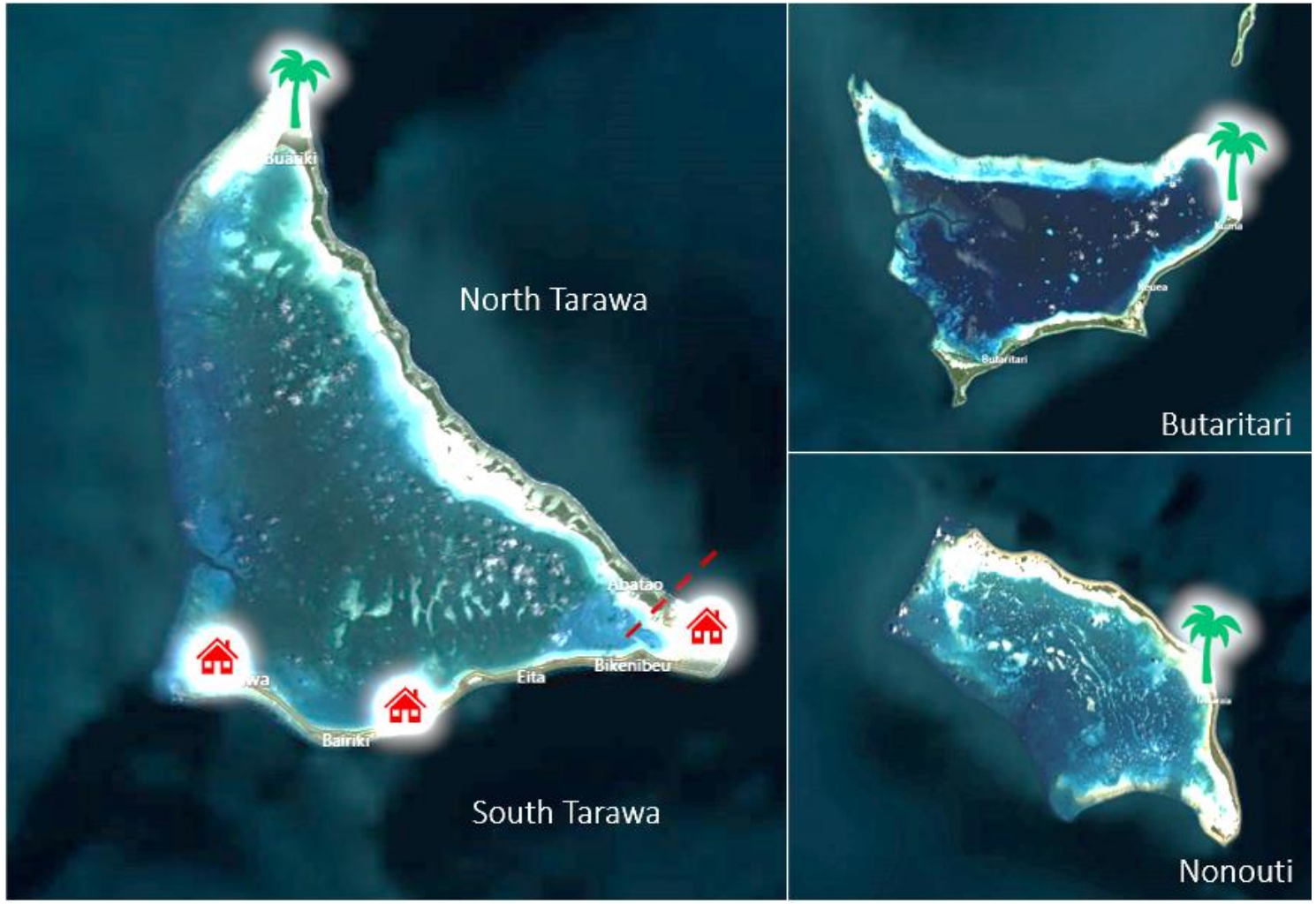
- Culture: Micronesian
- Max width: 300-400m
- Max height above sea level: ~3m
- fragile freshwater lens
- limited land availability for food
- limited infrastructure; very limited financial capacity for adaptation
- Remote; geographical spread

Atolls

Gilbert islands

Phoenix islands

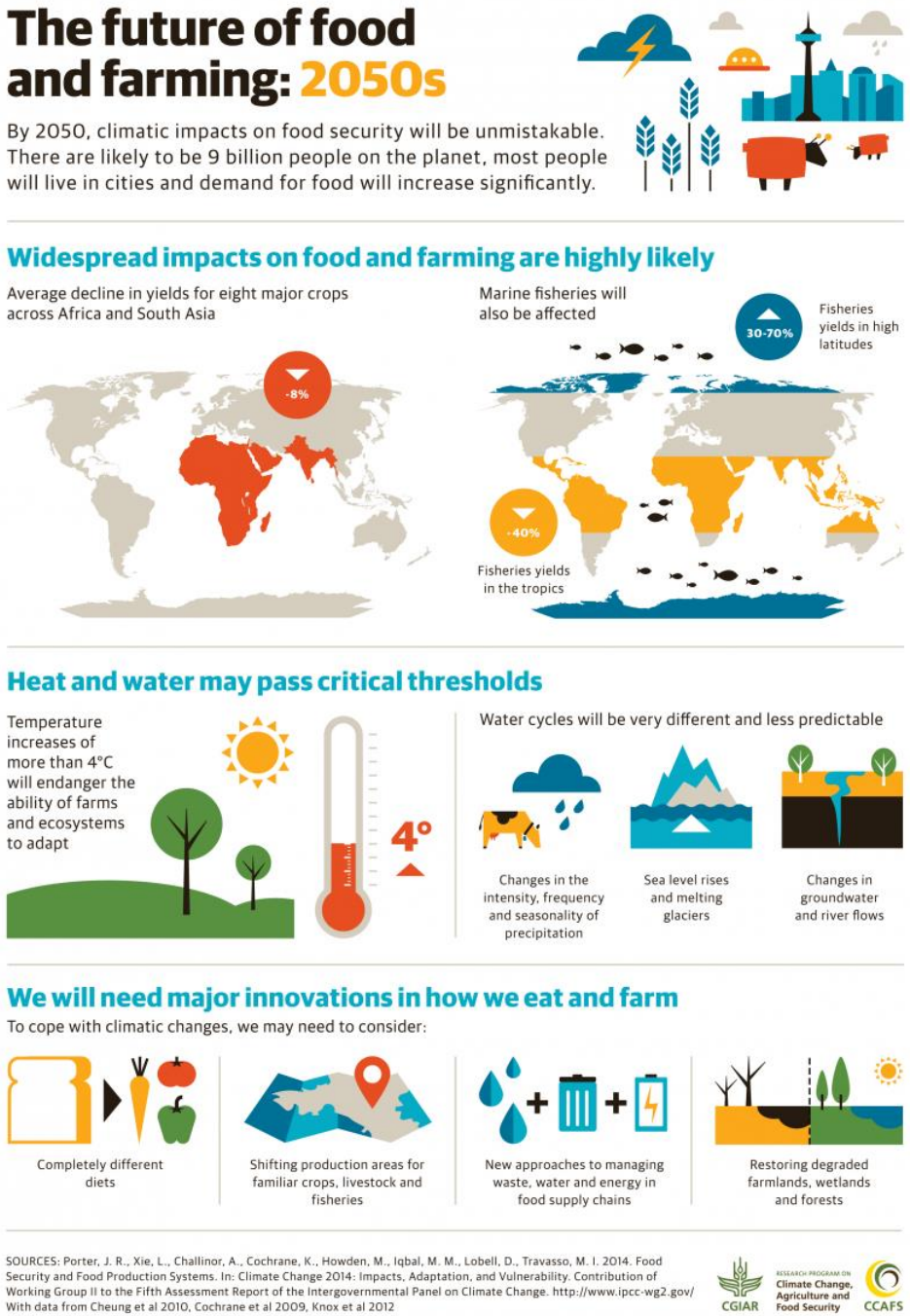
Line islands



Locations

Urban

Rural



Tier 2: Indirect effects: Food Security

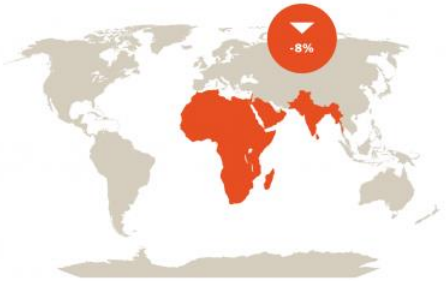
February, 2019: Kiribati, Central Pacific

The future of food and farming: 2050s

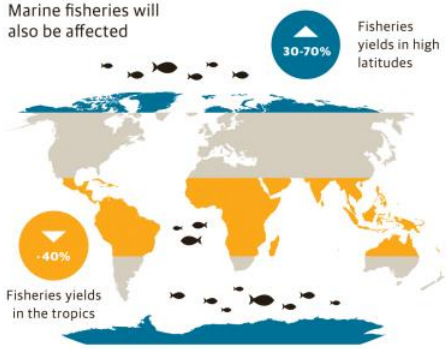
By 2050, climatic impacts on food security will be unmistakable. There are likely to be 9 billion people on the planet, most people will live in cities and demand for food will increase significantly.

Widespread impacts on food and farming are highly likely

Average decline in yields for eight major crops across Africa and South Asia

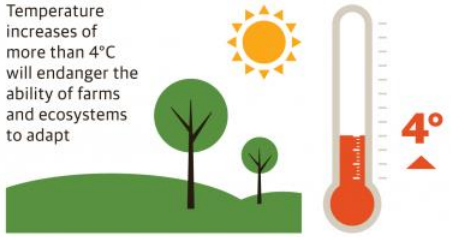


Marine fisheries will also be affected



Heat and water may pass critical thresholds

Temperature increases of more than 4°C will endanger the ability of farms and ecosystems to adapt



Water cycles will be very different and less predictable

Changes in the intensity, frequency and seasonality of precipitation

Sea level rises and melting glaciers

Changes in groundwater and river flows

We will need major innovations in how we eat and farm

To cope with climatic changes, we may need to consider:

Completely different diets

Shifting production areas for familiar crops, livestock and fisheries

New approaches to managing waste, water and energy in food supply chains

Restoring degraded farmlands, wetlands and forests

SOURCES: Porter, J. R., Xie, L., Challinor, A., Cochrane, K., Howden, M., Iqbal, M. M., Lobell, D., Travasso, M. I. 2014. Food Security and Food Production Systems. In: Climate Change 2014: Impacts, Adaptation, and Vulnerability. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change. http://www.ipcc-wg2.gov/
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CGIAR RESEARCH PROGRAM ON Climate Change, Agriculture and Food Security CCAFS

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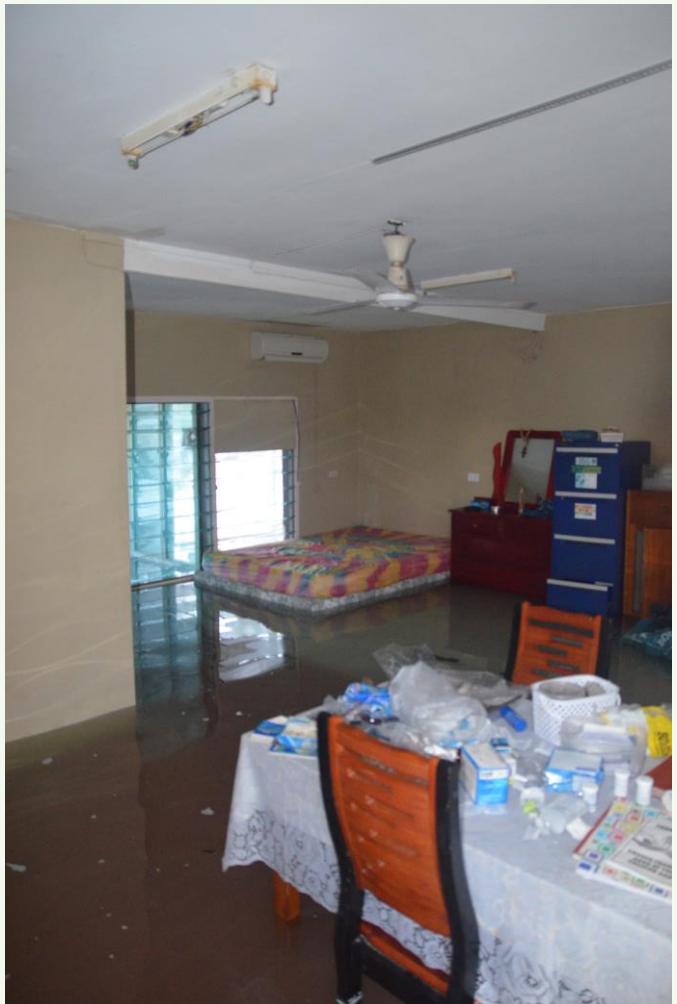

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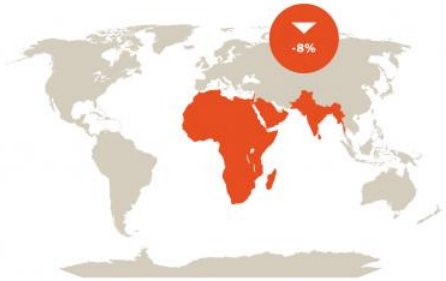

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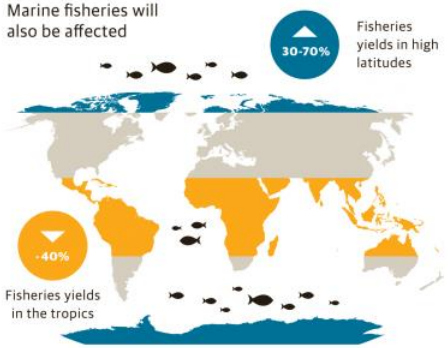

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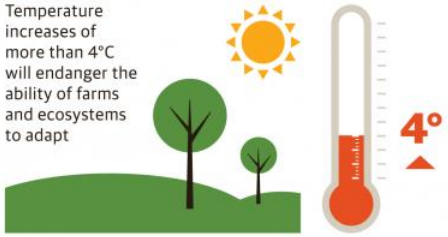

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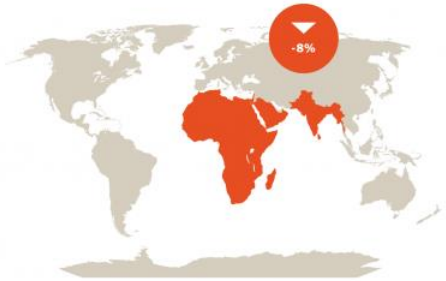

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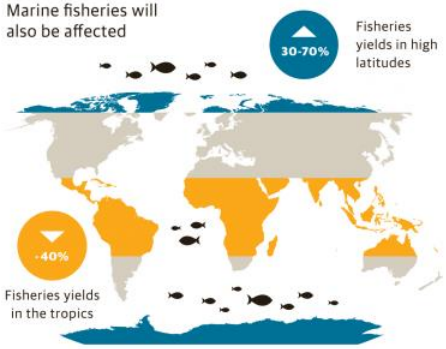

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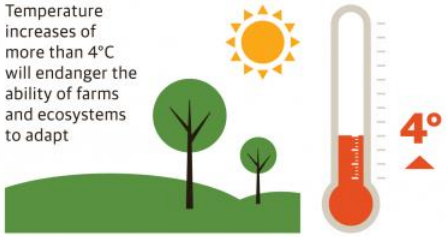

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Sea level rises and melting glaciers

Changes in groundwater and river flows

We will need major innovations in how we eat and farm

To cope with climatic changes, we may need to consider:

Completely different diets

Shifting production areas for familiar crops, livestock and fisheries

New approaches to managing waste, water and energy in food supply chains

Restoring degraded farmlands, wetlands and forests

SOURCES: Porter, J. R., Xie, L., Challinor, A., Cochrane, K., Howden, M., Iqbal, M. M., Lobell, D., Travasso, M. I. 2014. Food Security and Food Production Systems. In: Climate Change 2014: Impacts, Adaptation, and Vulnerability. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change. http://www.ipcc-wg2.gov/ With data from Cheung et al 2010, Cochrane et al 2009, Knox et al 2012

CGIAR RESEARCH PROGRAM ON Climate Change, Agriculture and Food Security CCAFS

Tier 2: Indirect effects: Food Security

February, 2019: Kiribati, Central Pacific

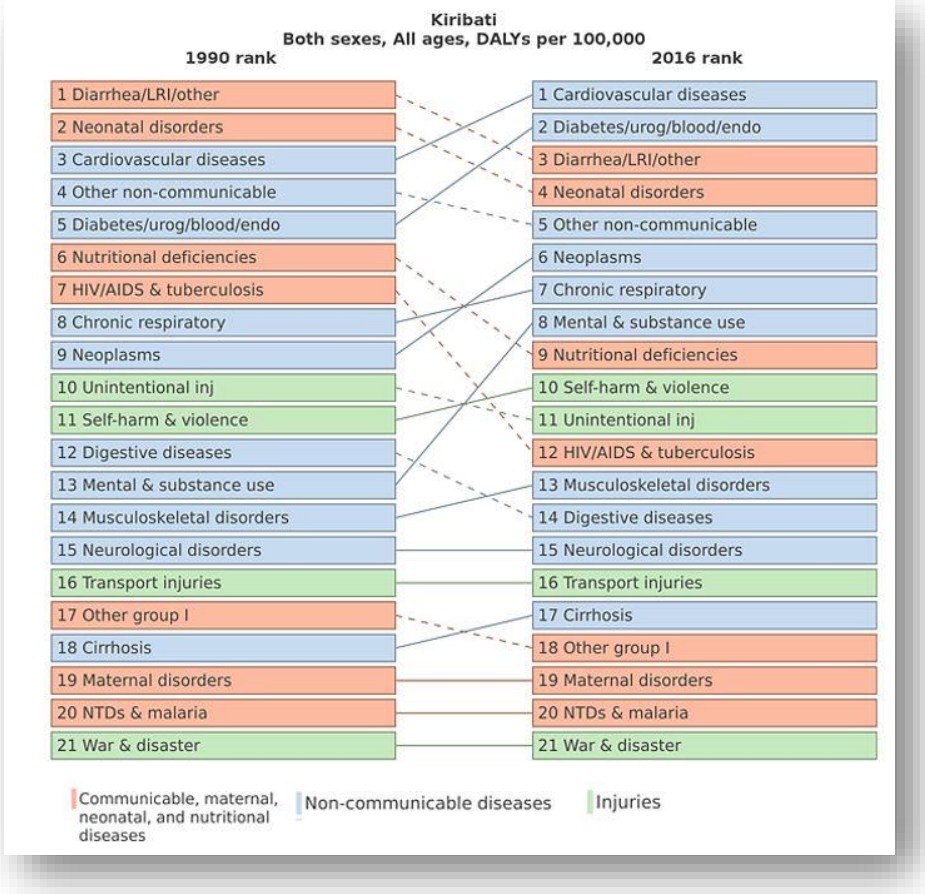
NCDs+++

Tier 2: Indirect effects: Food Security

SHARP INCREASE IN NONCOMMUNICABLE DISEASE

DIABETES, CARDIOVASCULAR DISEASE

NO SIGN OF SLOWING DOWN



Tier 2: Indirect effects : **Food Security**

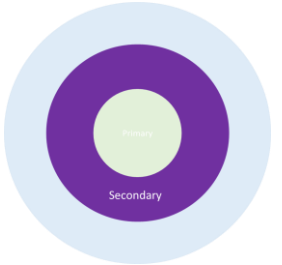
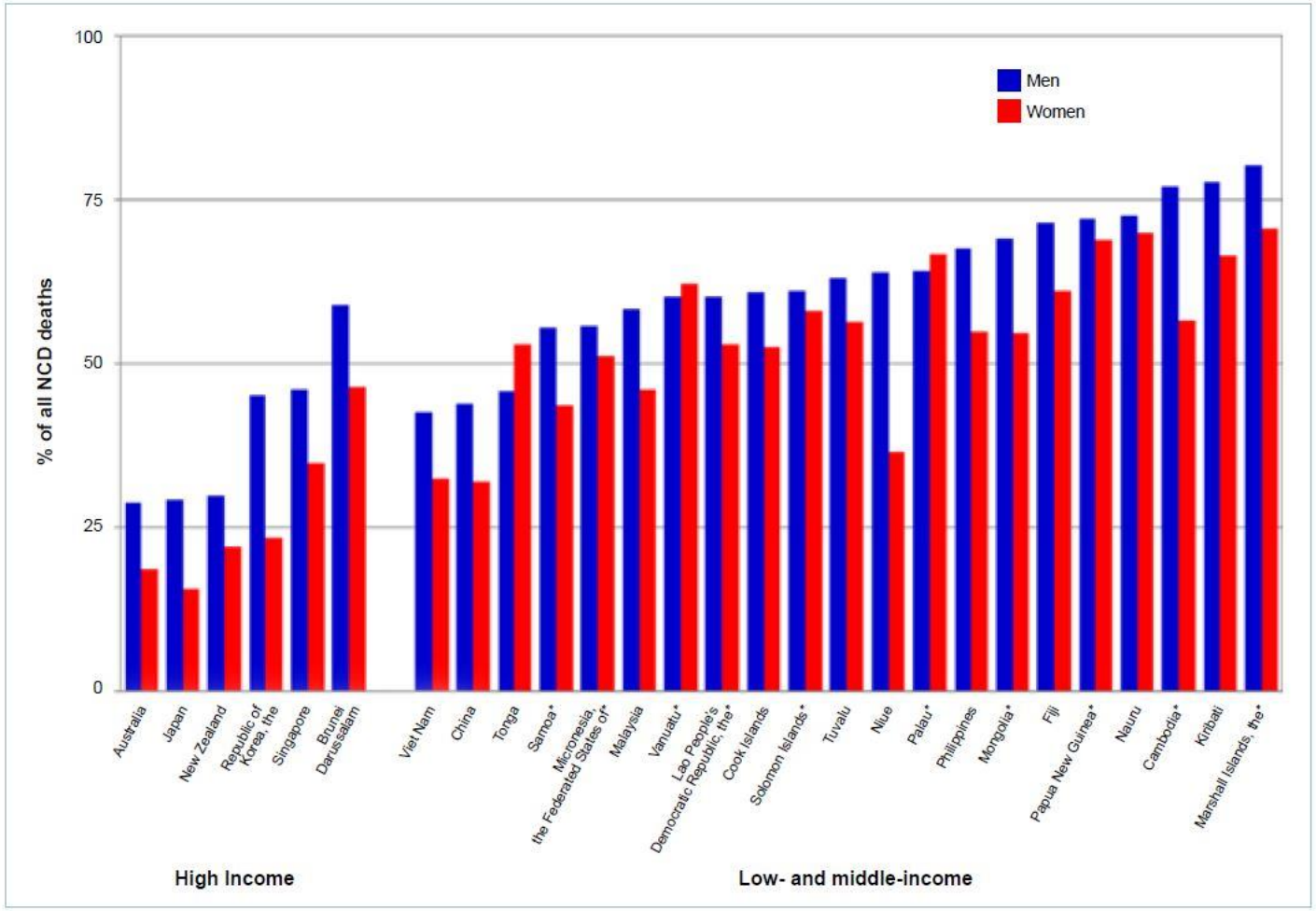


Figure 2. Percentage of all NCD deaths under age 70, Western Pacific Region, 2008



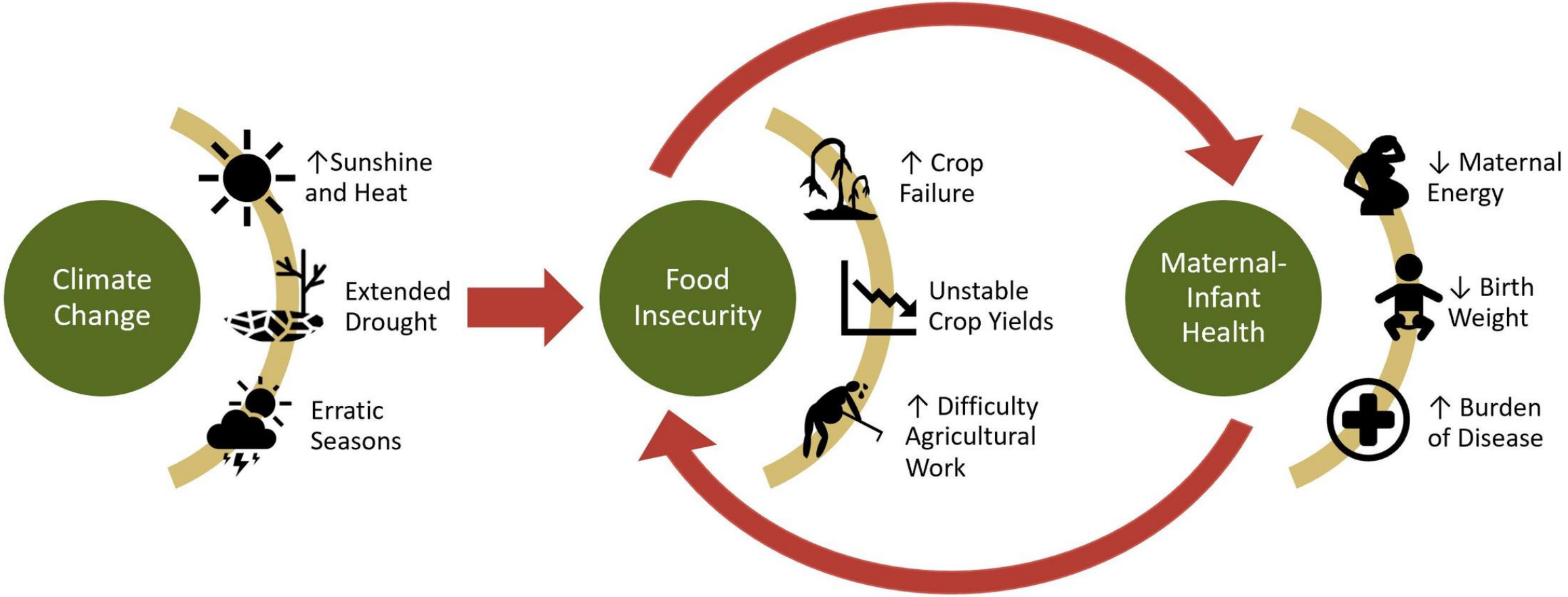
*Countries have a high degree of uncertainty because they are not based on national NCD mortality data. The estimates for these countries are based on a combination of country life tables, cause of death models, regional cause of death patterns, and WHO and UNAIDS programme estimates for some major causes of death (not including NCDs).

Source: Global status report on noncommunicable diseases. Geneva, WHO, 2011.

Climate change is a driver of food insecurity, leading to health consquences:

- Discouragement from pursuing local agriculture
- People move to eating imported food, which is often heavily processed/poor quality
- Leads to a significant rise in NCDs such as obesity, diabetes, hypertension

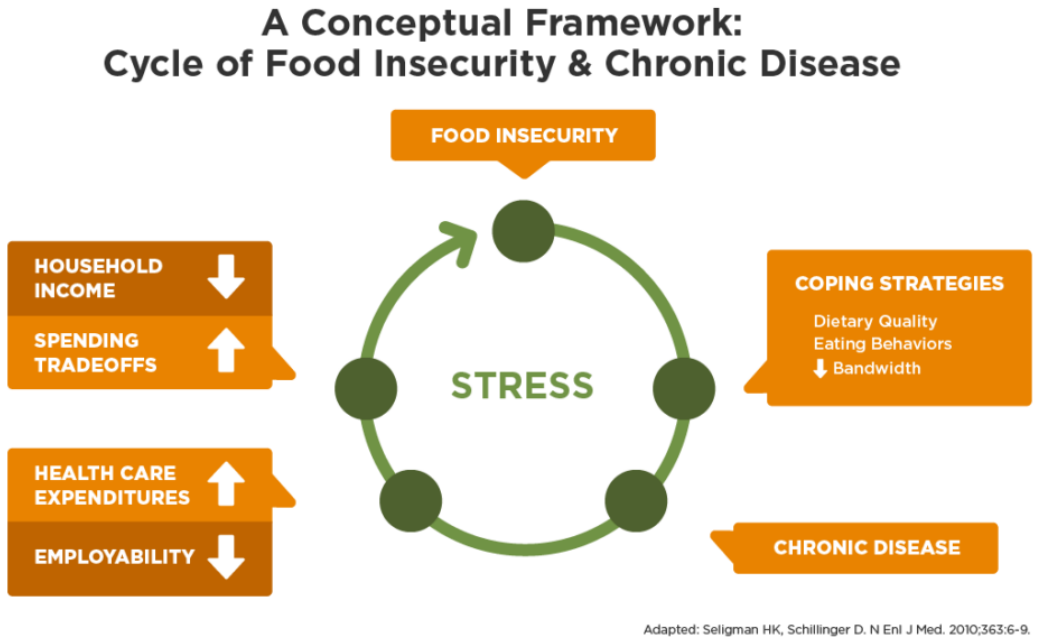
Tier 2: Indirect effects : **Food Security**



Source: Bryson et al, 2021: Seasonality, climate change and food security during pregnancy among indigenous and non-indigenous women in rural Uganda: Implications for maternal-infant health.

Health impacts of low food security

- Decreasing food security leads to lower household income available for other expenditures.
- Lower food quality leads to the emergence of poor health patterns, chronic disease, lower quality of life
- Chronic disease may lead to shorter life expectancy, decreased mental health, decreased employability, fostering the cycle of low food security and rising stress.



Mental health impact of food crop destruction

- Loss of self worth, inability to feed or sustain families
- Severe psychological impact on livelihoods of farmers
- Farmers do not feel empowered to change – partly due to socioeconomic conditions, partly because they do not have assistance from the state.
- Food is an important part of cultural life and expression. What can we expect with climate change, and how will it affect us spiritually, culturally and economically?

Suicides of nearly 60,000 Indian farmers linked to climate change, study claims

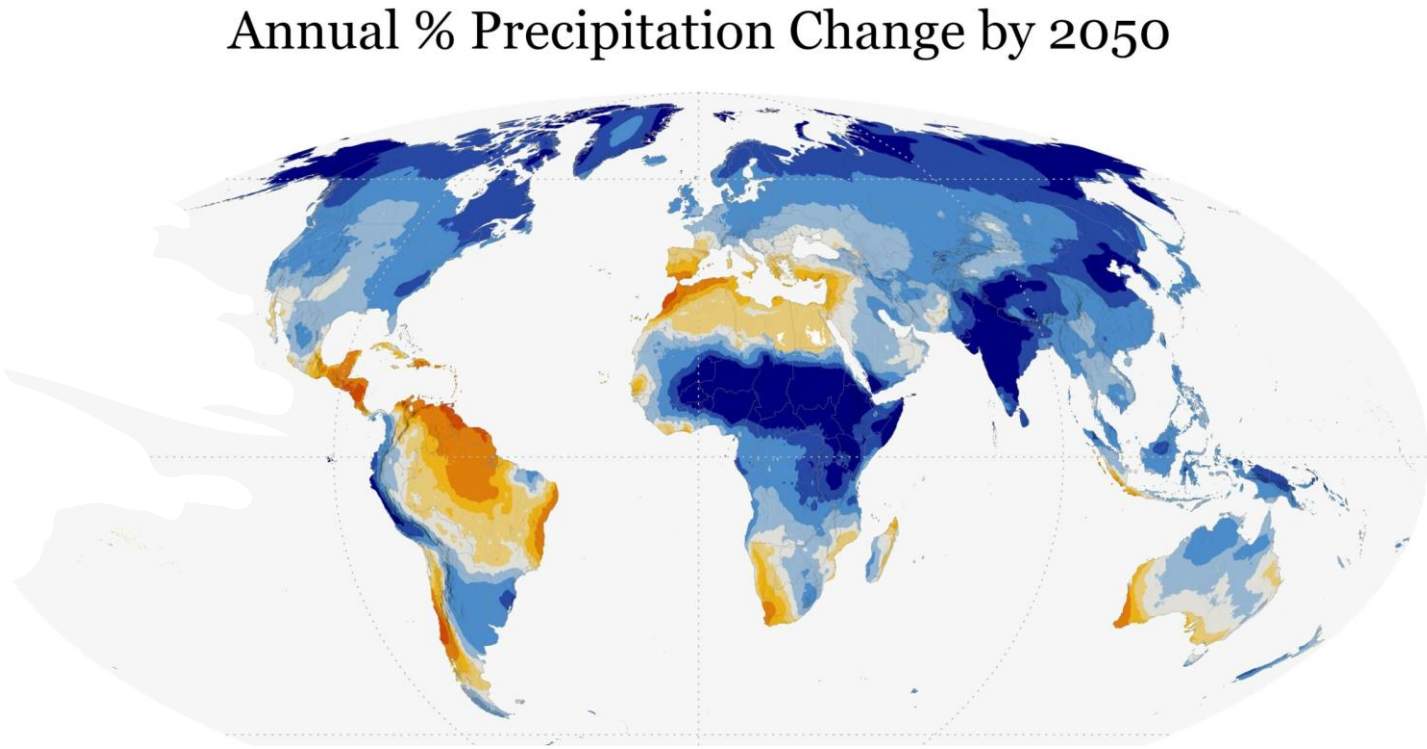
Rising temperatures and the resultant stress on India's agricultural sector may have contributed to increase in suicides over the past 30 years, research shows

Farmers from Tami Nadu demonstrate in Delhi with what they say are the bones of farmers who committed suicide because of a crippling drought and high debt. Photograph: Julian Chung/The Guardian

Tier 2 Indirect Effects: Water Security

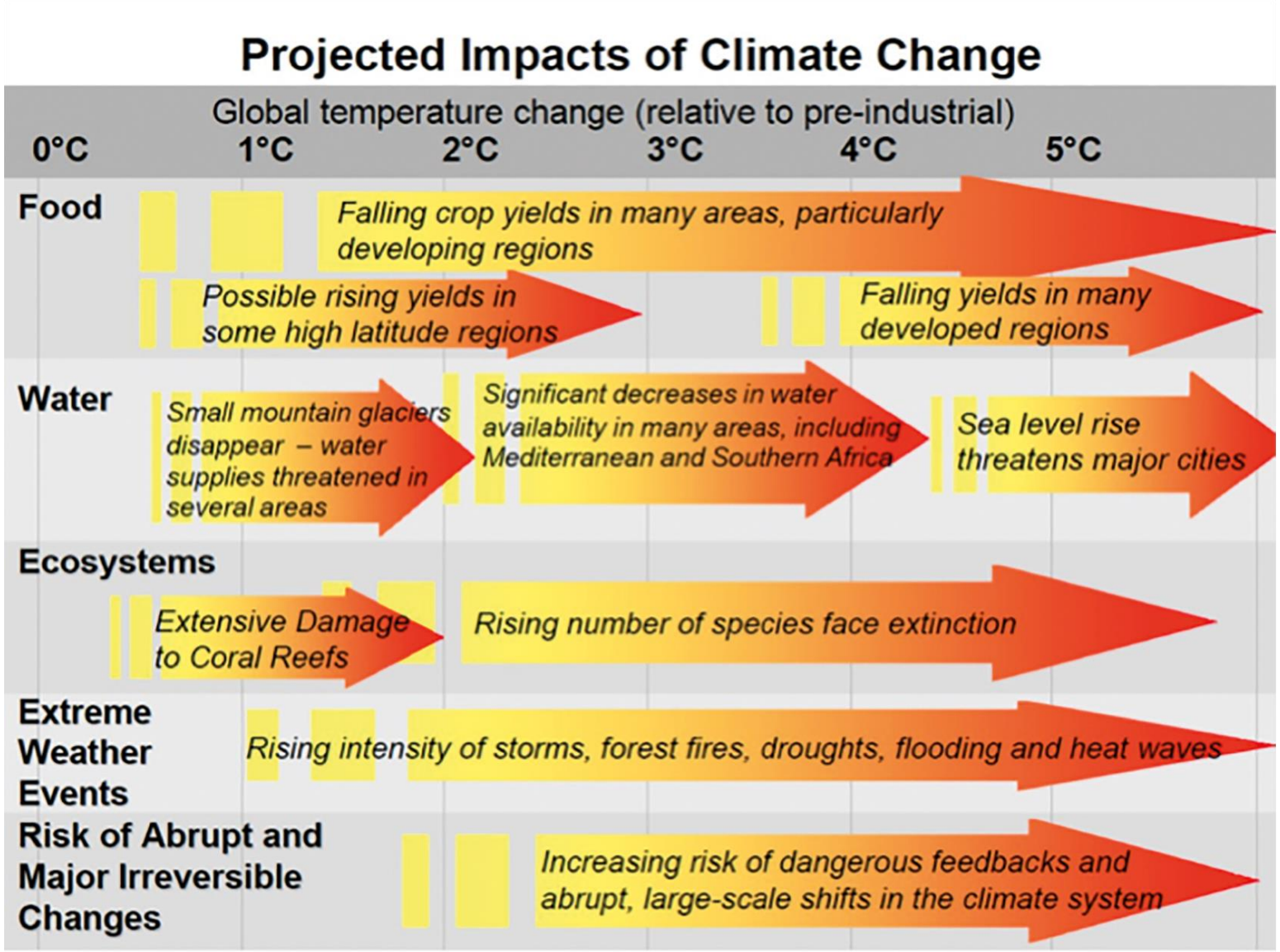
A warmer atmosphere holds more moisture, about 7% more, per 1°C.

This also means that the atmosphere becomes more ‘supercharged’ – storms become more common, producing heavier rain and snow, but with longer periods of drought in most areas.



Tier 2
Indirect effects

Water Security



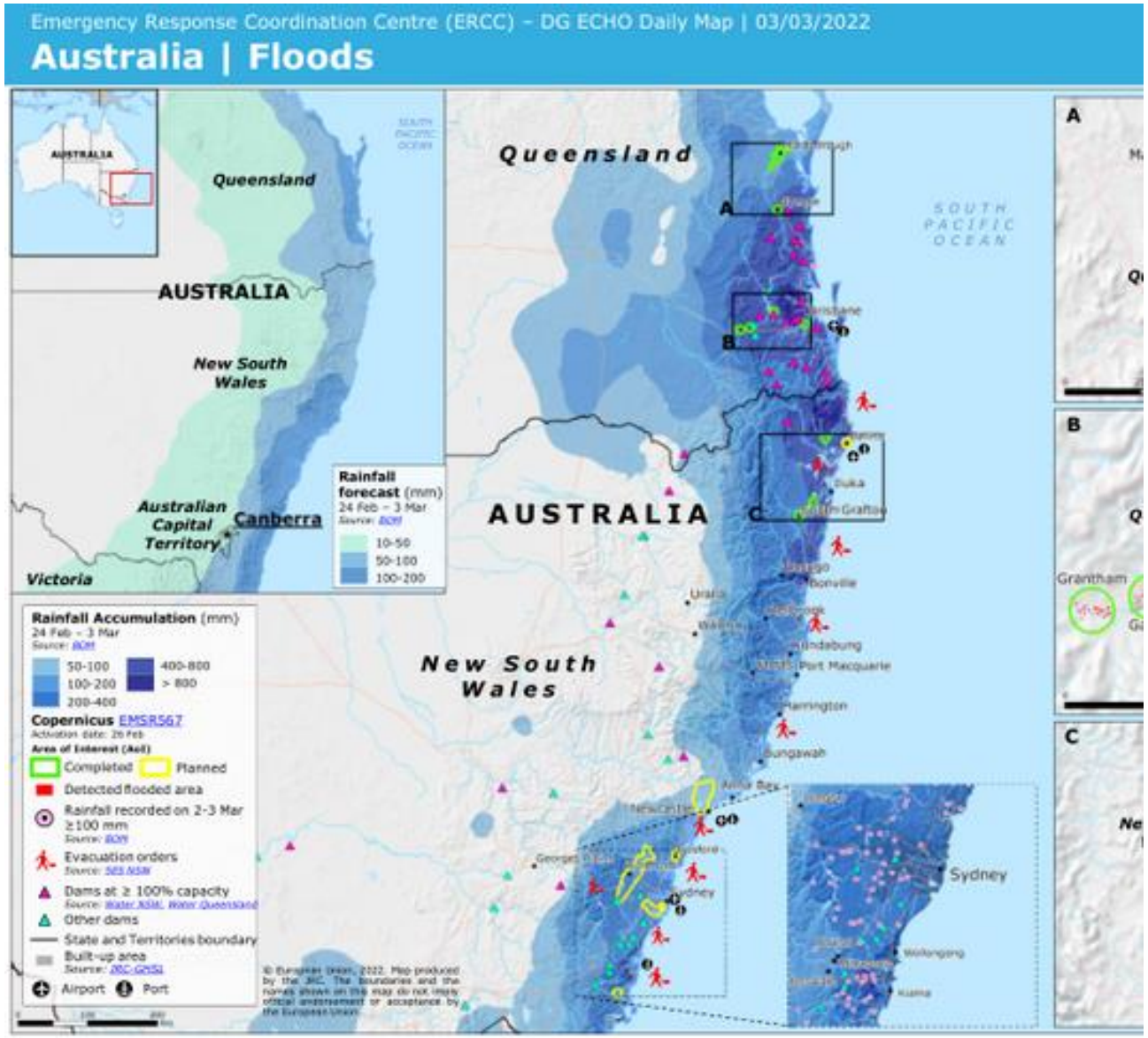
Pakistan Floods, 2022. 1/3rd of the country under water

Tier 2 Indirect effects:
Water Security

- Melting snowpacks/glaciers
- Sea level rise
- Unseasonality
- Extreme rainfall / drought
- Disease

All these have a significant effect on water supply, in terms of water safety, availability, capacity

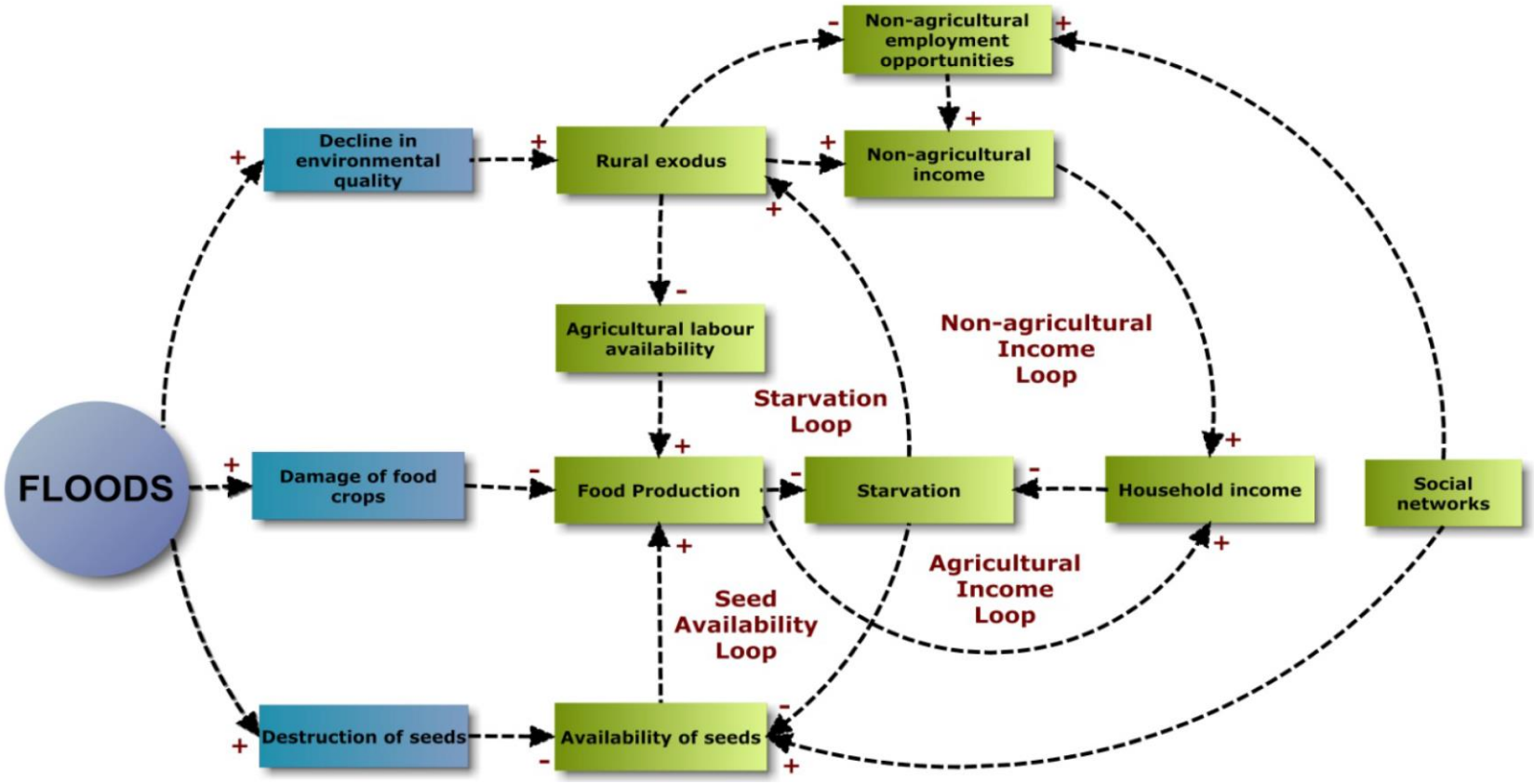

ROAD SUBJECT TO
FLOODING
INDICATORS SHOW DEPTH


Emergency Response Coordination Centre (ERCC) – DG ECHO Daily Map | 03/03/2022
Australia | Floods
Queensland
AUSTRALIA
New South Wales
Australian Capital Territory
Canberra
Victoria
SOUTH PACIFIC OCEAN
Rainfall forecast (mm)
24 Feb – 3 Mar
10-50
50-100
100-200
Rainfall Accumulation (mm)
24 Feb – 3 Mar
50-100
100-200
200-400
400-800
> 800
Copernicus EMSR567
Area of Interest (AoI)
Completed
Planned
Detected flooded area
Rainfall recorded on 2-3 Mar ≥100 mm
Evacuation orders
Dams at ≥ 100% capacity
Other dams
State and Territories boundary
Built-up area
Airport
Port
Sydney
Brisbane
Grafton
Port Macquarie
Newcastle
Wollongong
Grantham

Tier 2 Indirect effects: Water Security

- Damage from extreme weather due to excessive rainfall can include extensive economic damage, infrastructure destruction, mental health problems, infectious diseases, death.

- Also effects food security due to crop destruction/ soil erosion

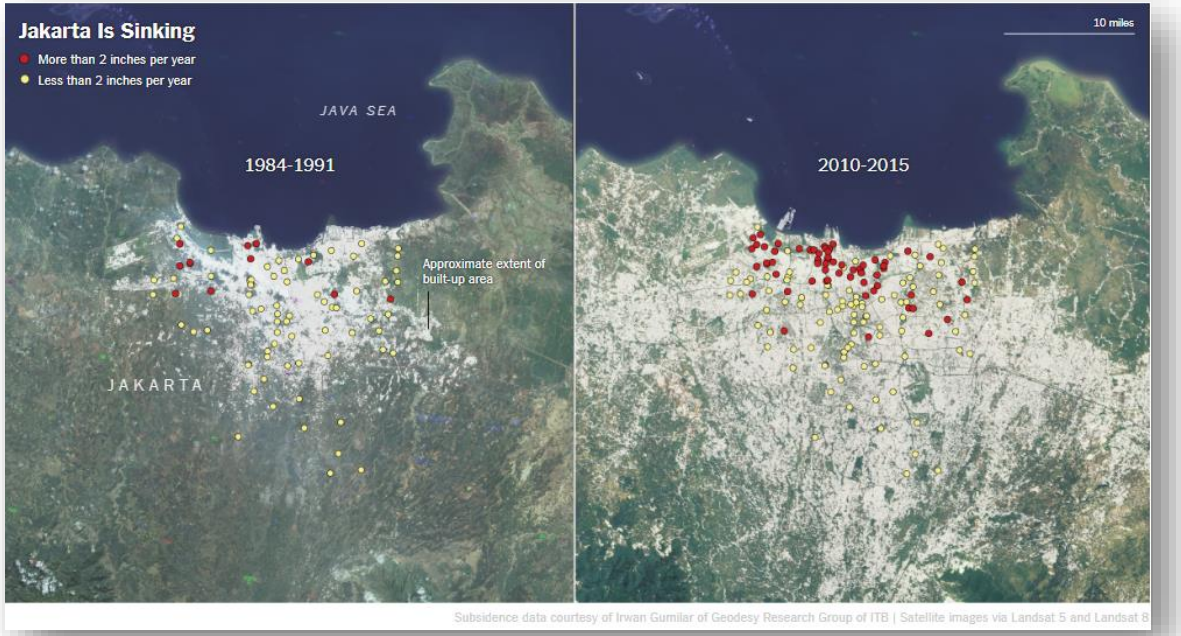


Case Study: Jakarta.
Population 10.5 million (2020)

The New York Times | WORLD

Changing Climate, Changing Cities

Jakarta Is Sinking So Fast, It Could End Up Underwater



In Java, the water is running out

KATE WALTON

Drought, pollution, and poor resource management threaten Indonesia's most populous island with total water scarcity.

Some of the worst water shortages are felt on Java – Indonesia's most populous island, home to more than 60% of the population, many of its largest cities, and much of its agriculture. For all this human abundance, Java is seriously lacking in water, holding just 10% of the nation's water supplies.

Indonesia's Ministry of Public Works and Housing has predicted that Java's water levels will drop to 476m^3 per person per year by 2040. This is categorised as "total scarcity" and is far below the current annual level of 1169m^3 per capita. The ministry says the ideal per capita amount of water is 1600m^3 per year. Almost 10% of Indonesia is expected to experience water crisis by 2045, while Java is already considered to be "under pressure".

Case study: Jakarta

- While the city is sinking due to water uptake, sea level rise will cause existential problems for the city
- Adapt or fade – cities have been abandoned over time in history, and Jakarta may suffer the same fate.
- What will happen to millions of people living in Jakarta? Uprooting communities, poverty, mental health anxieties

Jakarta: Water security

True water security calls for our protection of 'invisible' water

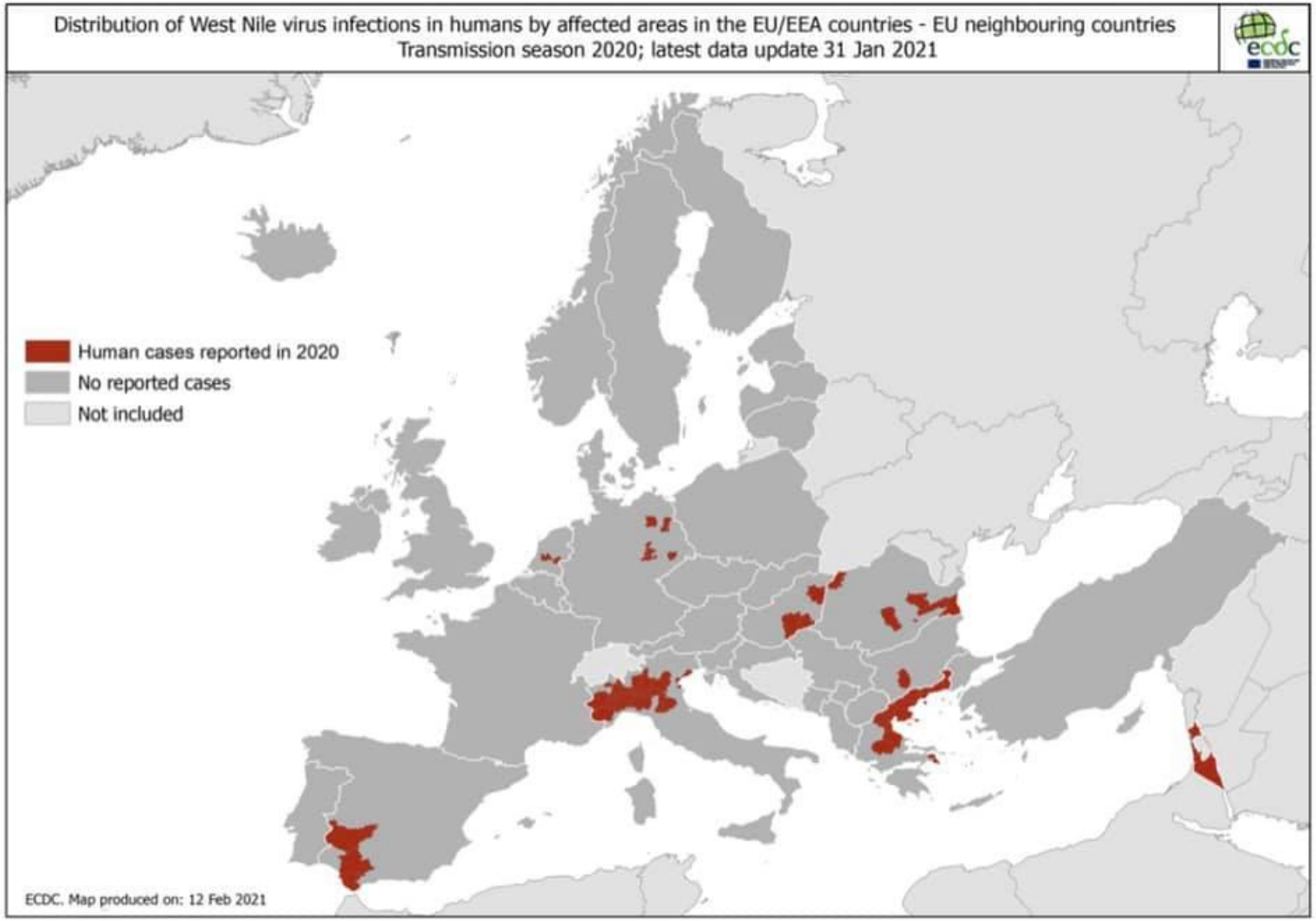
Non-potable: A child uses a hand water pump in Kali Besar, West Jakarta, on Oct. 29, 2019. The water, hov cannot be consumed because it has been contaminated by sea water. (JP/P.J.Leo)

Source: Jakarta Post

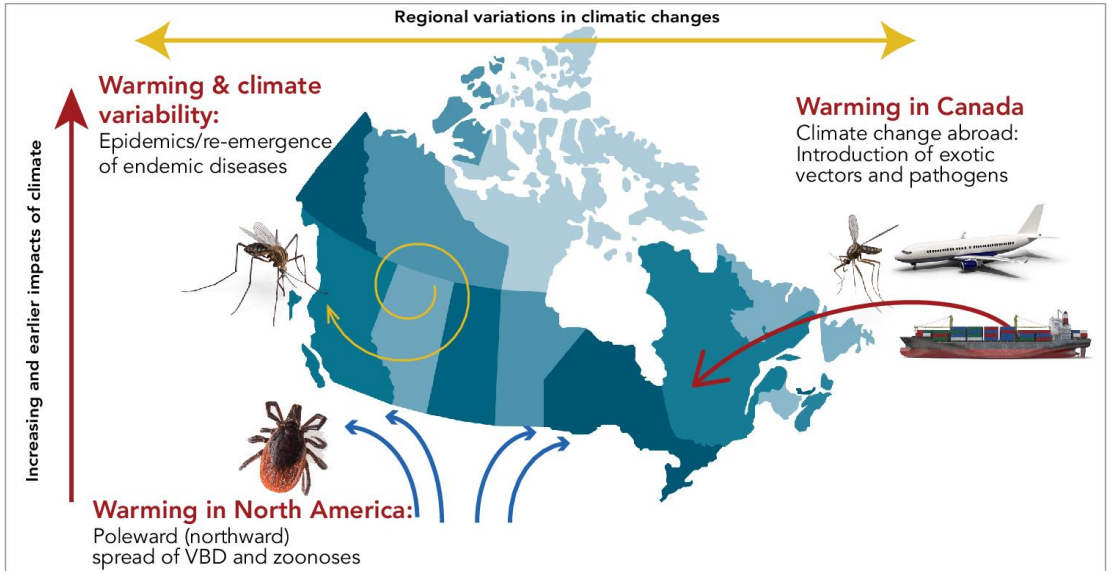
- As water tables are increasingly contaminated by sea water and pollution, health problems increase.
- We need to design our cities around these problems, which could spell the death of vibrant communities and vast cities.
- A 2019 report found that groundwater is an especially important resource, with 90 percent of households using groundwater as their primary source of drinking water in Indonesia.

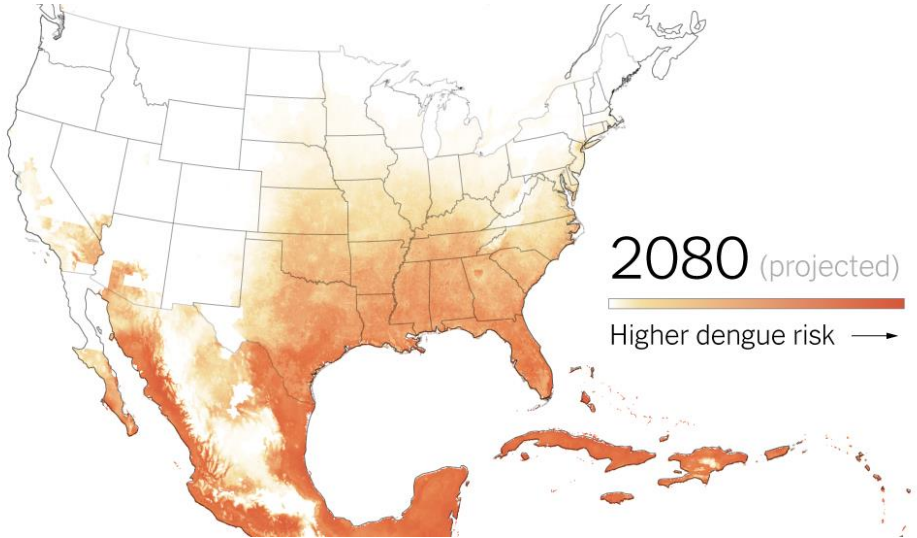
Tier 2 Indirect effects:
Existential threats of Sea Level Rise

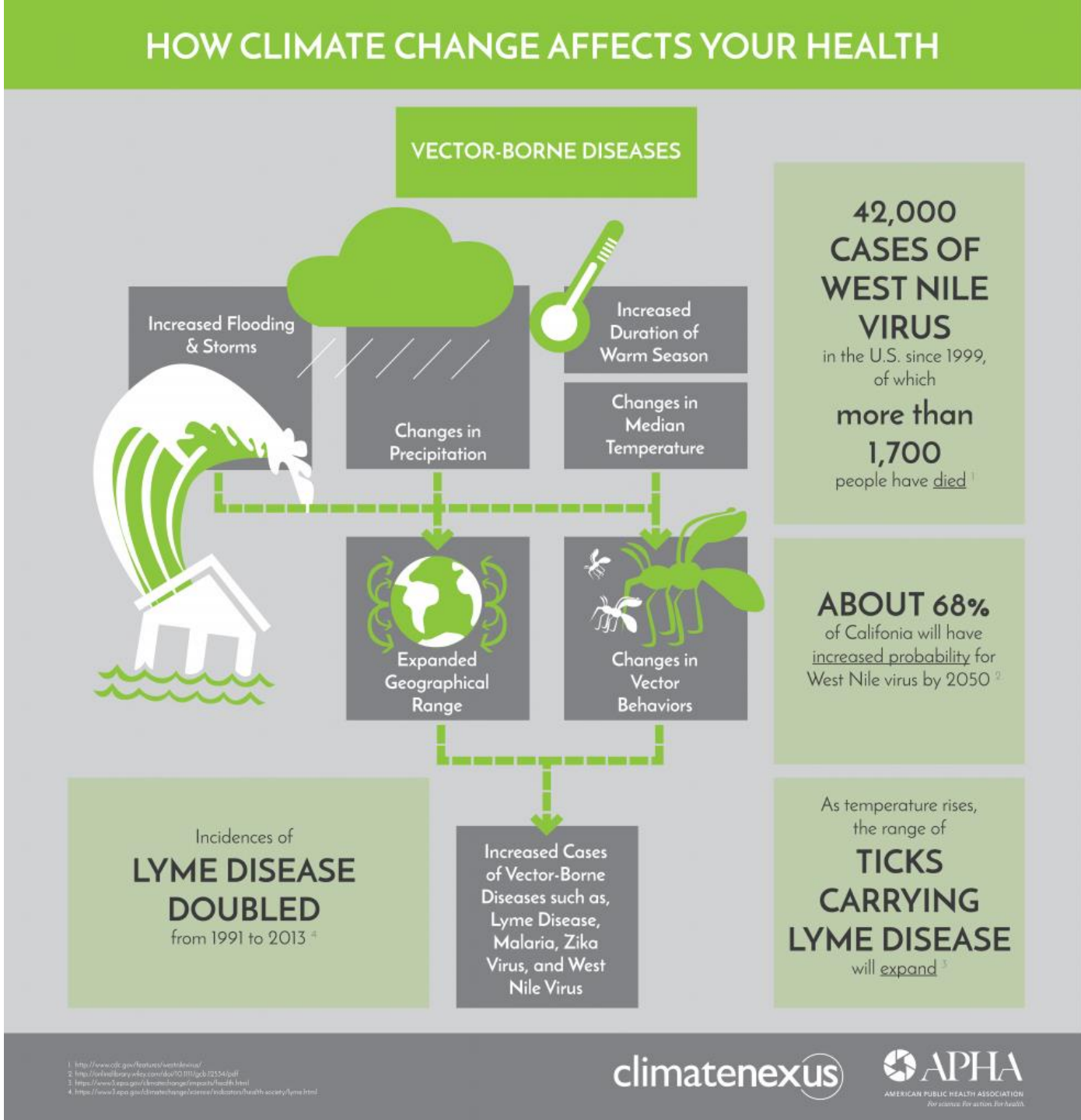
Tier 2 Indirect effects: Infectious Diseases



Tier 2 Indirect effects: Infectious Diseases







Example:
Indonesia - at risk of tropical diseases

JAKARTAGLOBE NEWS | BUSINESS | LIFESTYLE | TECH

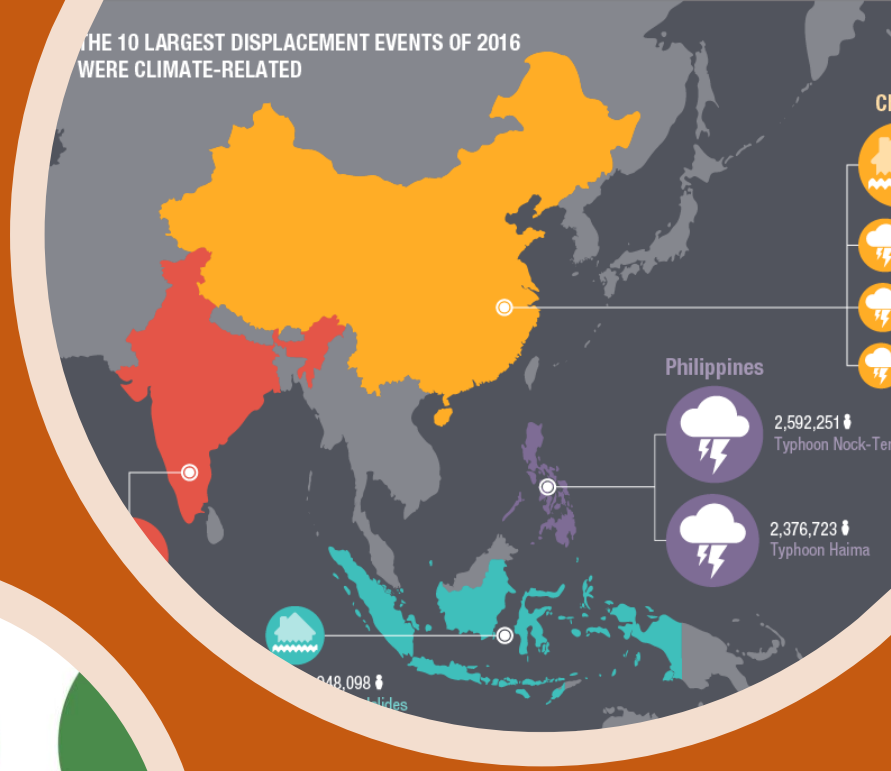
Malaria Threat Resurfaces Due to Climate Change and Covid-19

BY :MAGGIE LEUNG
AUGUST 25, 2021

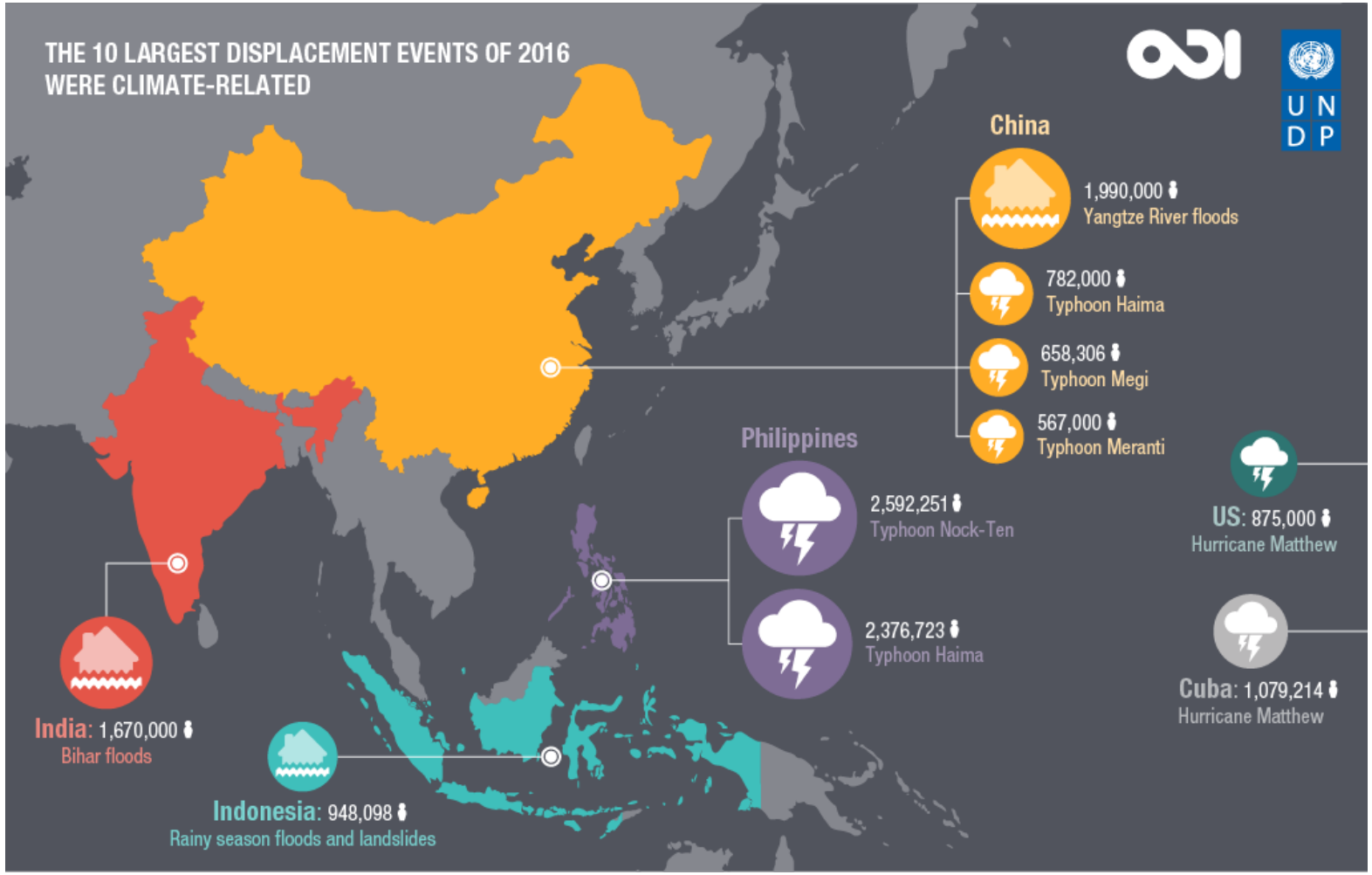
Singapore. The Asia-Pacific region is under threat of Vector Borne Disease (VBDs) especially in face of climate change and the evolving Covid-19 challenge. In a recent landmark study by the United Nation's Intergovernmental Panel on Climate Change, the extreme weather conditions caused by climate change have provided rising hurdles for disease control.

Diffuse Effects

- Mental health
- Migration
- Conflict

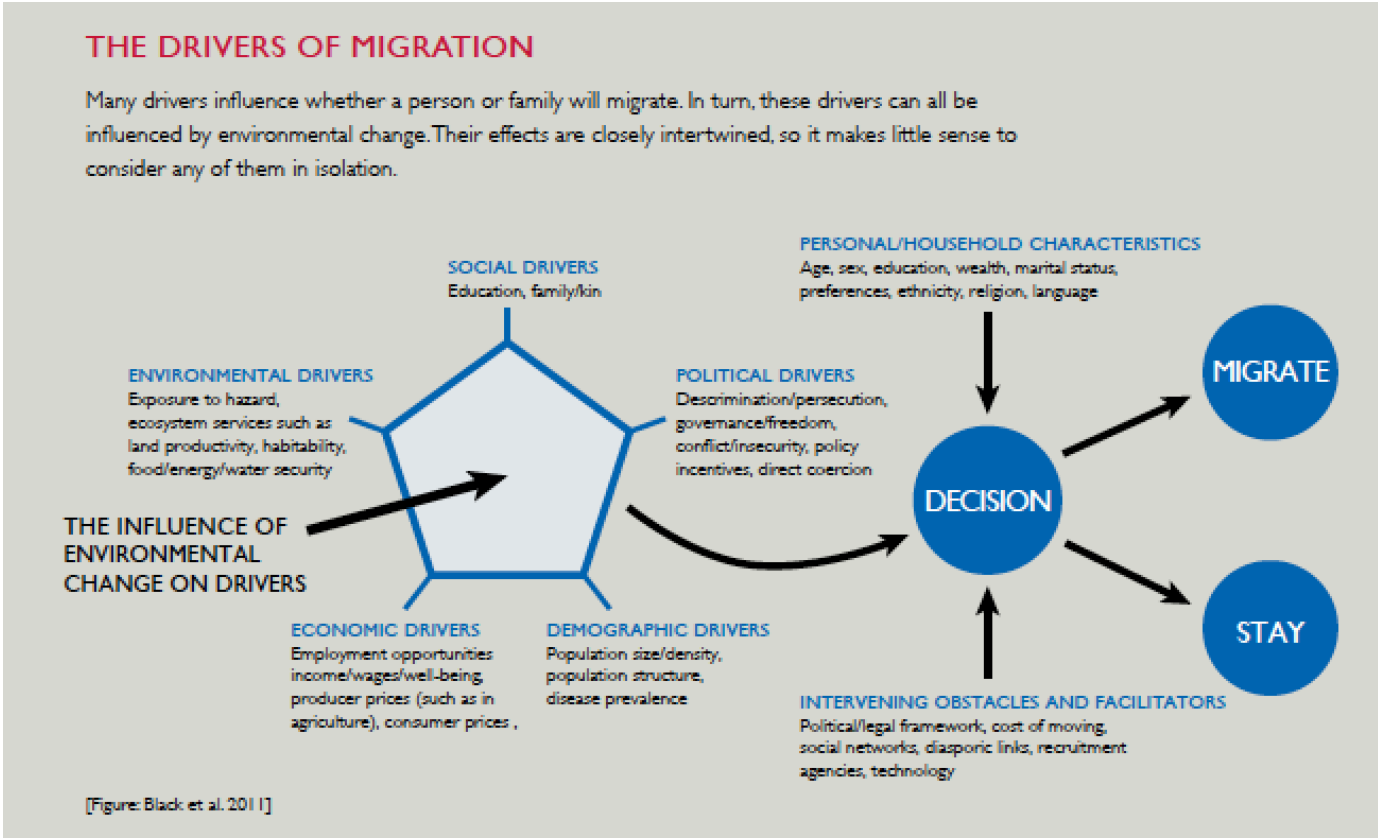


Tier 3 Diffuse Effects: Migration



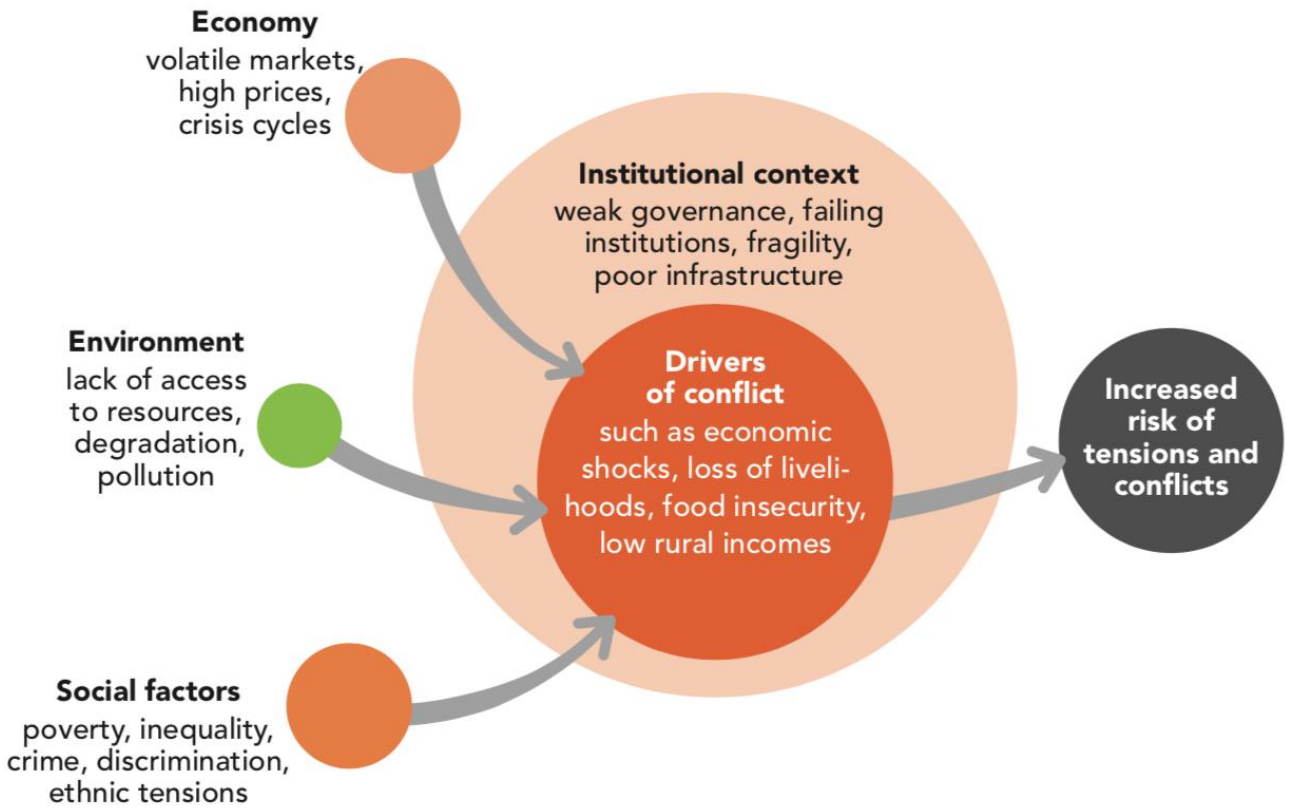
As Sea levels rise and weather becomes increasingly erratic, will be on the move in the coming decades

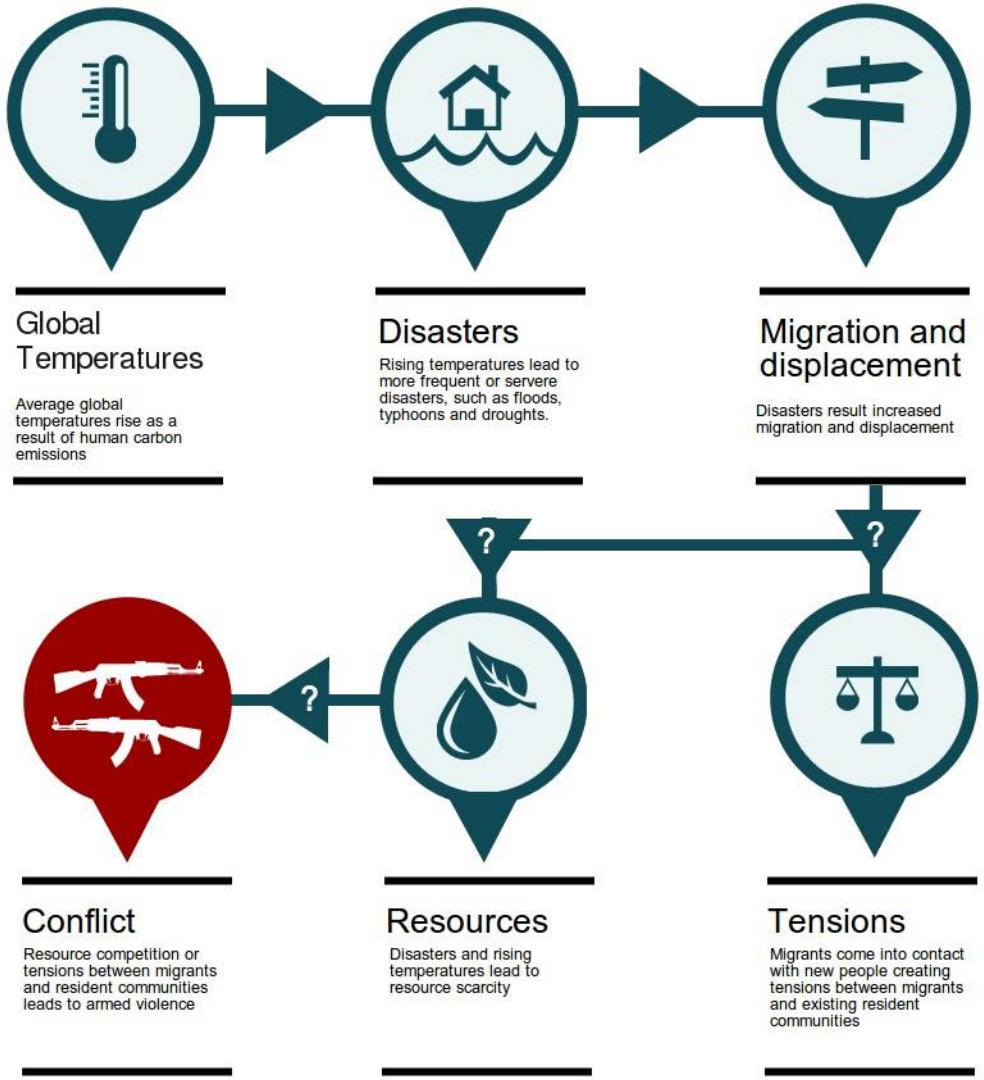
Tier 3 Diffuse Effects: Migration



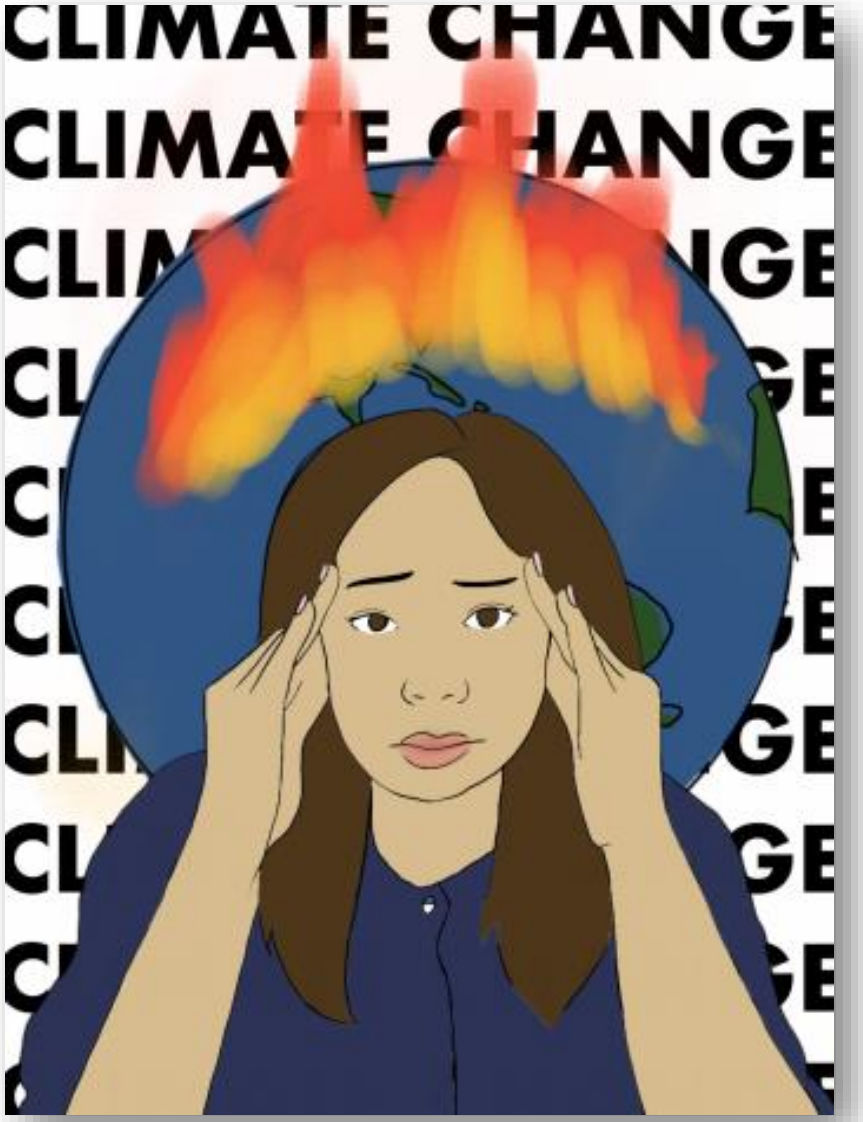
Tier 3 Diffuse Effects: Conflict

Domino effect of climate change could trigger conflict

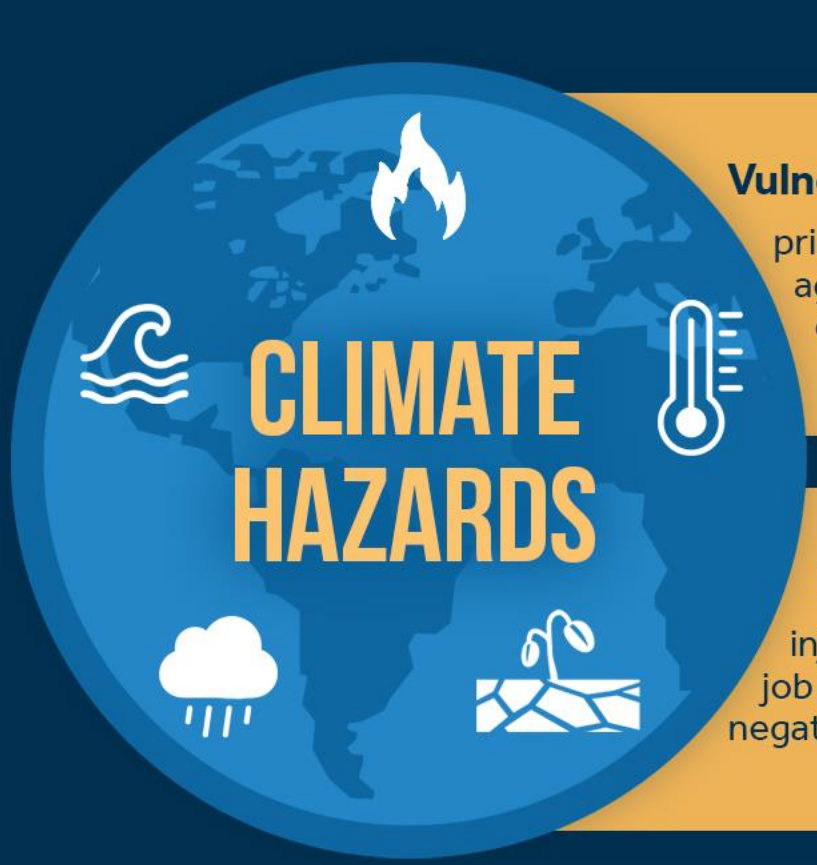




Tier 3 Diffuse Effects: **Mental Health**



Climate Change & Mental Health



Vulnerability

prior illness, gender, age, inequities, occupation

Exposure

injury, displacement, job loss, observing negative impacts

Mental Health Risks

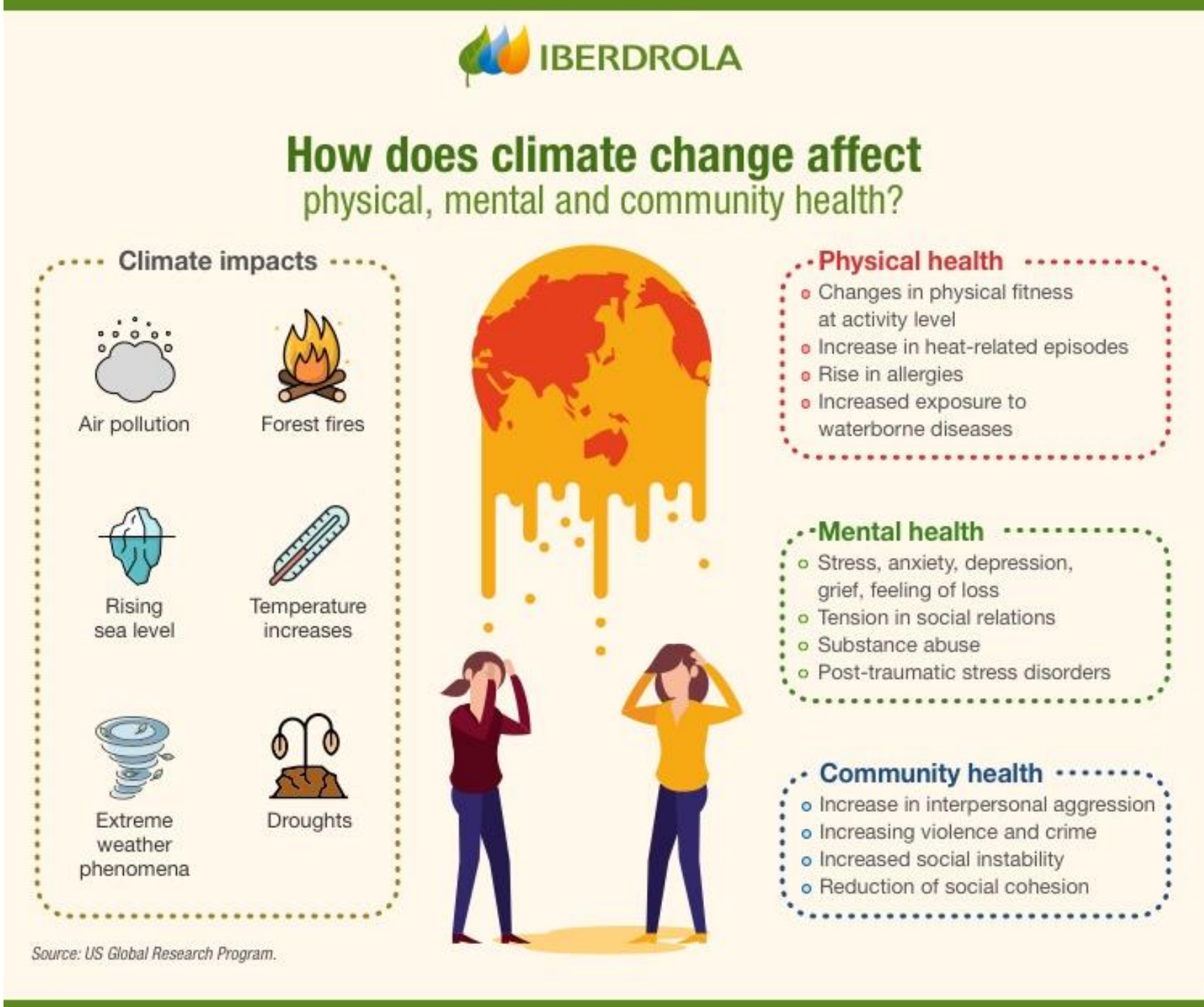
- **Mental illness:** PTSD, depression, suicide
- **Reduced well-being:** stress, climate anxiety

Source: Adapted from IPCC AR6 WGII Ch 7 (2022) & health2016.globalchange.gov Ch 8 (2016).

CLIMATE CENTRAL

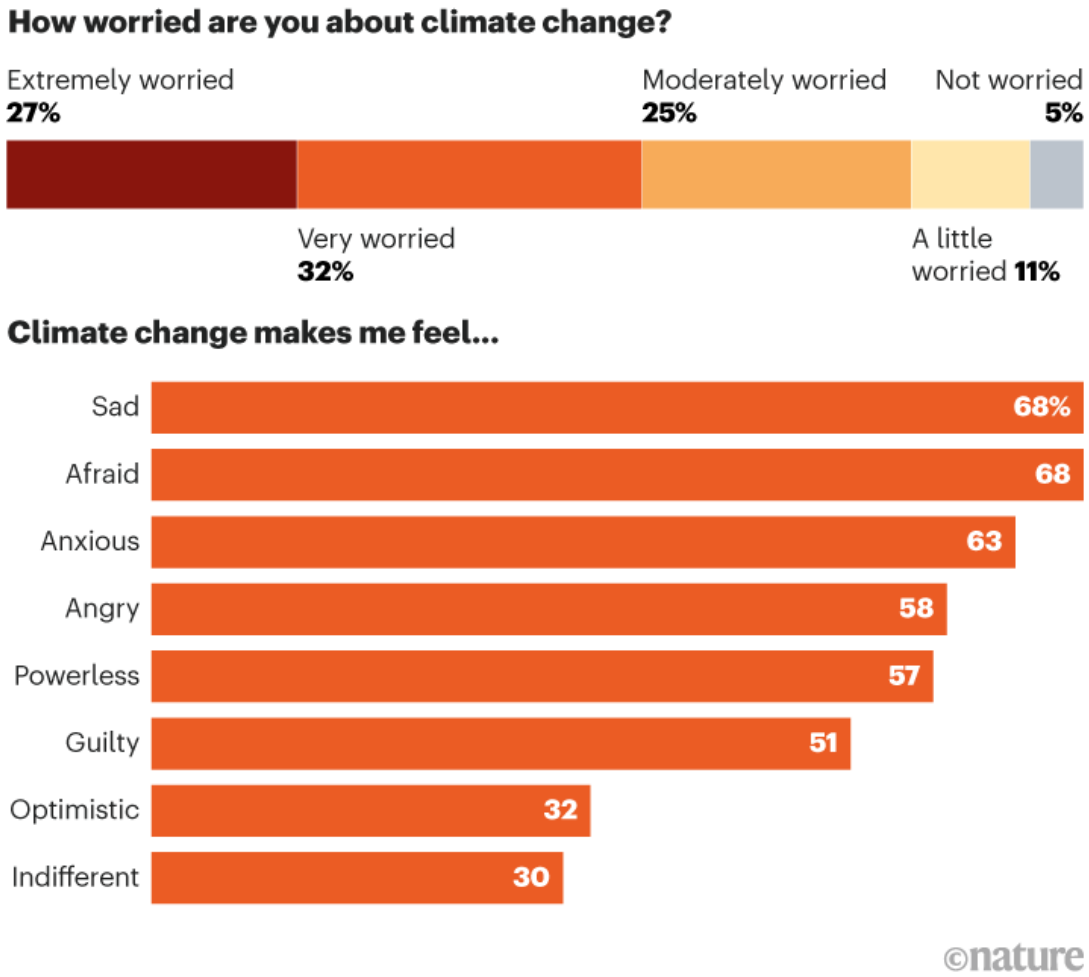
Tier 3
Diffuse Effects: Mental Health

- Loss of culture
- Loss of community
- Eco-anxiety
- Lack of hope in the future
- Inability to plan ahead



CLIMATE ANXIETY

A survey of 10,000 young people shows that negative feelings about climate change can cause psychological distress.



Source: Hickman, C. *et al., Lancet (2021).* https://www.thelancet.com/journals/lanplh/article/PIIS2542-5196(21)00278-3/fulltext

Generation Dread

Finding Purpose in an Age of Climate Crisis

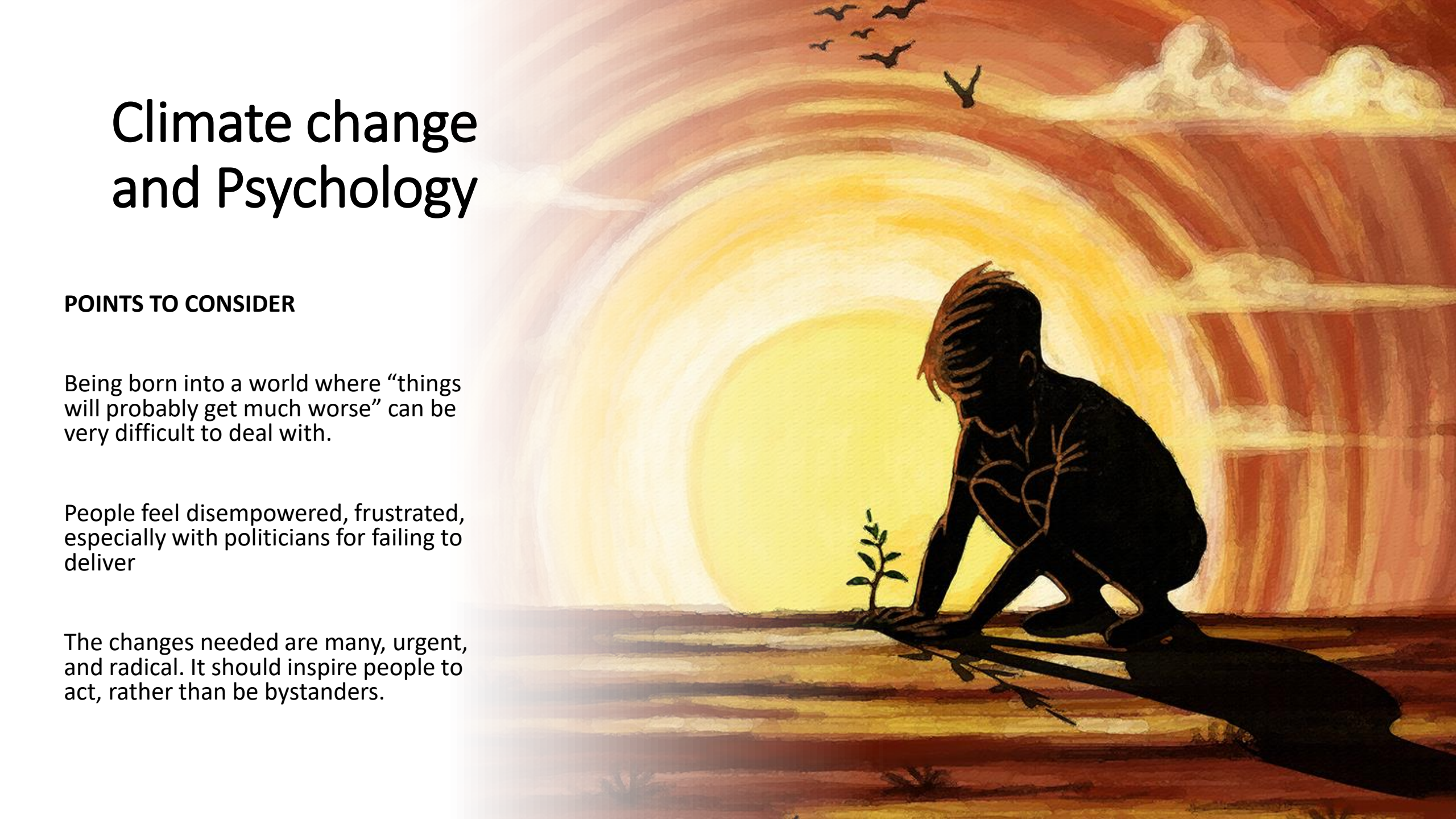
Climate change and Psychology

POINTS TO CONSIDER

Being born into a world where “things will probably get much worse” can be very difficult to deal with.

People feel disempowered, frustrated, especially with politicians for failing to deliver

The changes needed are many, urgent, and radical. It should inspire people to act, rather than be bystanders.



Questions to reflect on

- Eco-anxiety is on the rise worldwide, leading to a growing sense of dread and depression.
- We underestimate the impact of a growing mental health crisis at our peril.
- We are still in time to make the necessary changes to mitigate climate change (although some adaptation will be necessary)

Part 3: The Way Forward

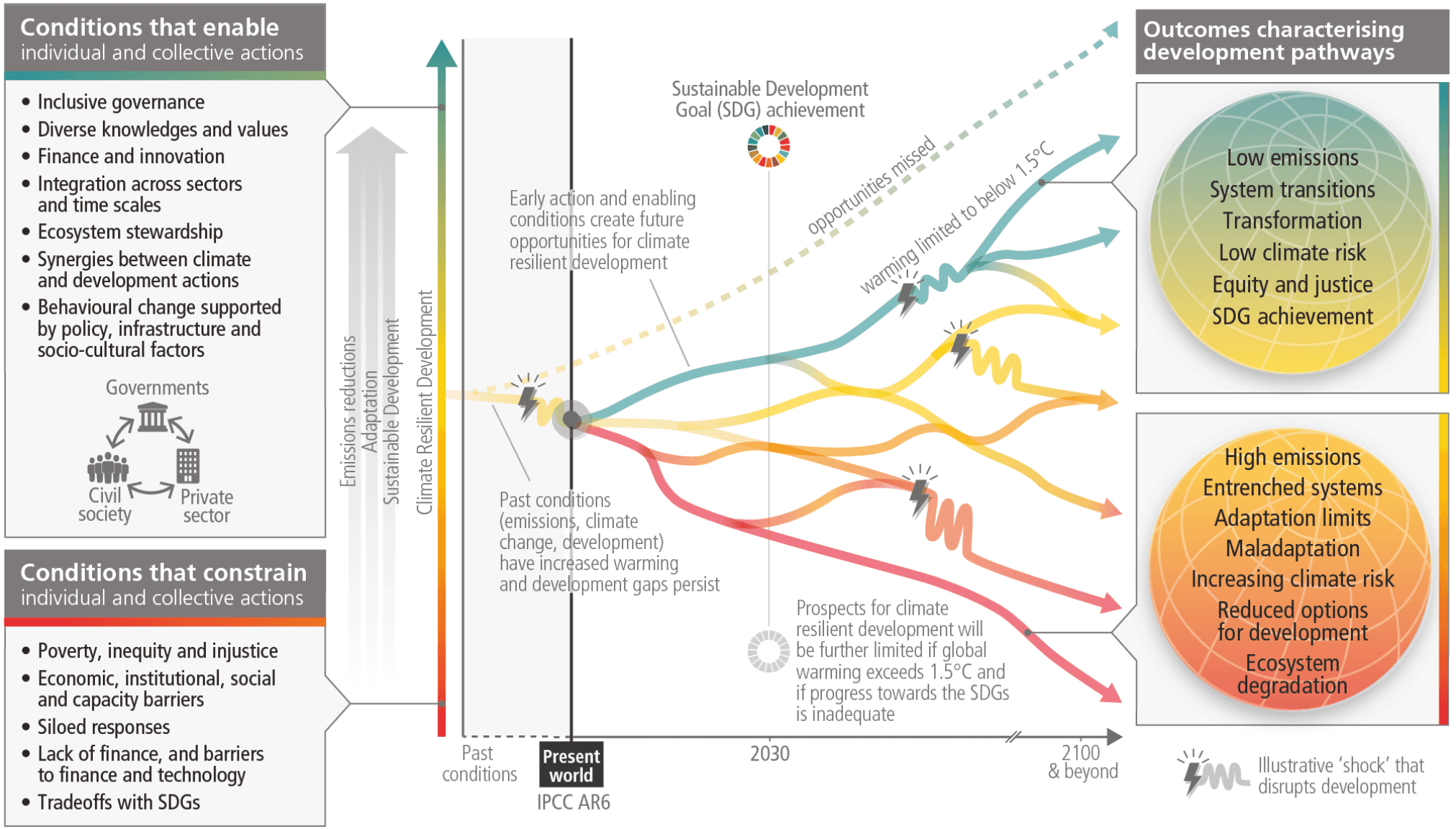

From helplessness to action – options for difficult times

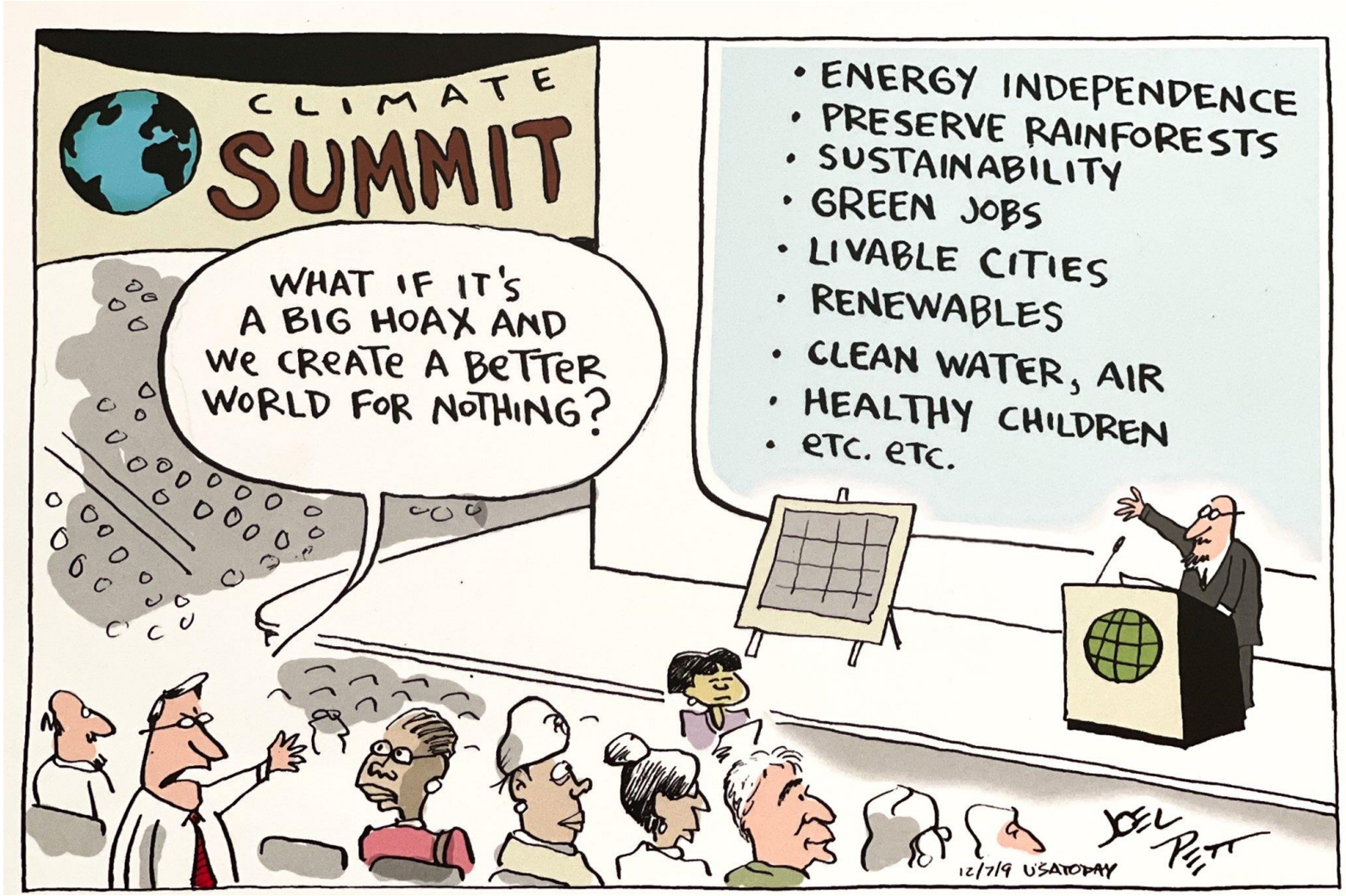
The Good News

- The changes we need to implement to mitigate climate change and adapt to it have real tangible benefits to:
    - Improve our health
    - Strengthen our communities
    - Enhance our general wellbeing
- **We can turn this crisis into an opportunity**
- Inspiring others to **speak out, act and intervene** to improve our lives and deal with climate change would lead to positive improvements in all spheres, including health.

There is a rapidly narrowing window of opportunity to enable climate resilient development

Multiple interacting choices and actions can shift development pathways towards sustainability

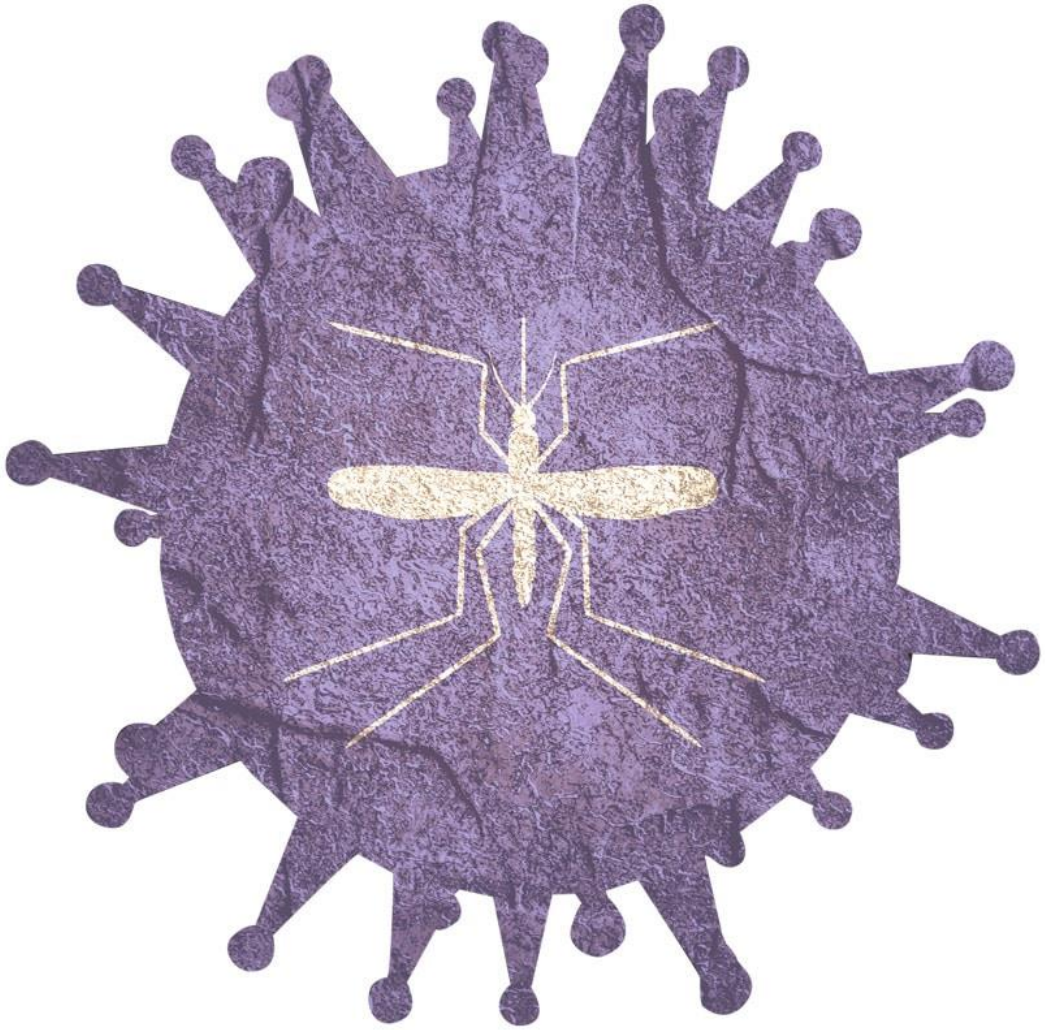



CLIMATE
SUMMIT
WHAT IF IT'S A BIG HOAX AND WE CREATE A BETTER WORLD FOR NOTHING?
• ENERGY INDEPENDENCE
• PRESERVE RAINFORESTS
• SUSTAINABILITY
• GREEN JOBS
• LIVABLE CITIES
• RENEWABLES
• CLEAN WATER, AIR
• HEALTHY CHILDREN
• ETC. ETC.
12/7/19 USATODAY
JOEL PETT

Public Health
Be prepared

- Preparing infrastructure for increasing extreme weather events
- Consulting with public health experts in any policy
- Stop compartmentalising, start connecting

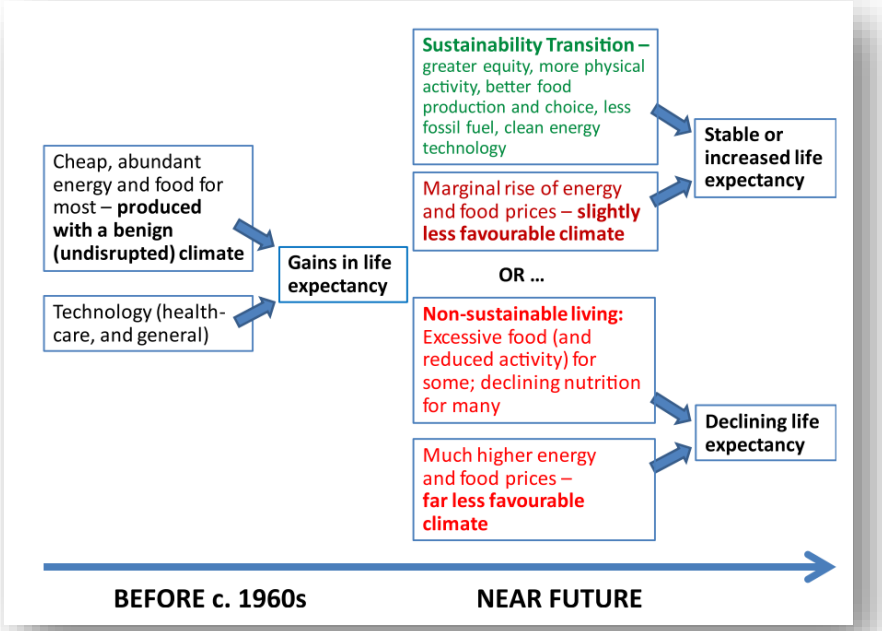
‘Health in all’ policy approach



Public Health strategies to tackle Climate Change

- Various possibilities, but ultimately **synchronise well** with general public health goals

- E.g. healthier diets, encouraging active commutes, integrated communities



Public Health strategies to tackle Climate Change

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- E.g. healthier diets, encouraging active commutes, integrated communities

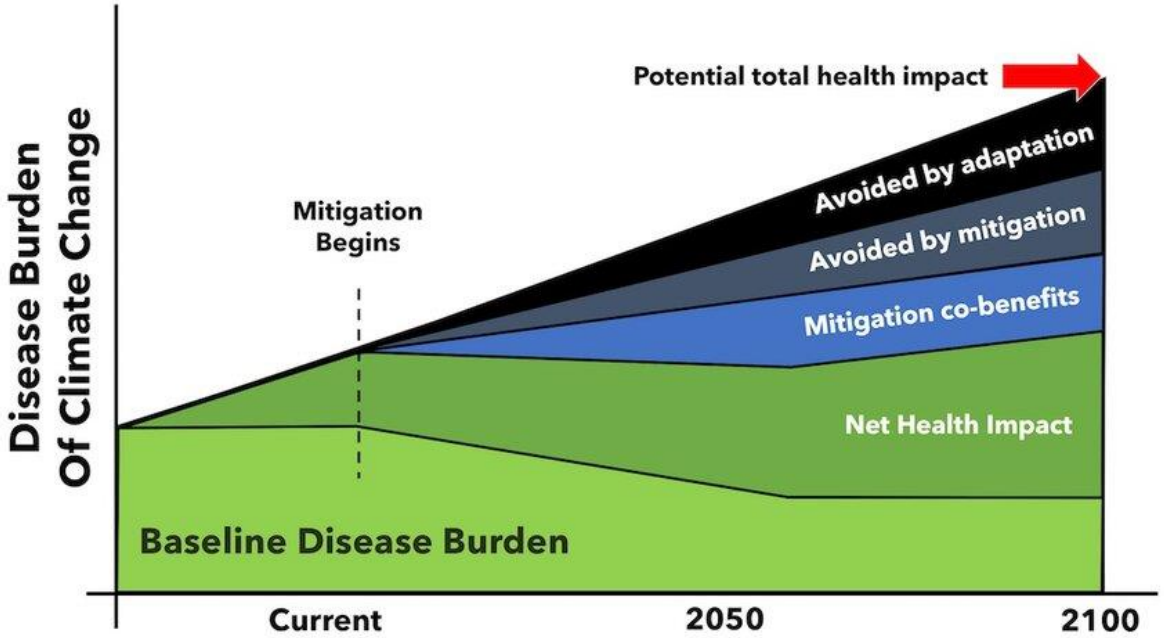
Table 3. Role of the Health Sector in Climate-Change Mitigation (Primary Prevention) and Adaptation (Preparedness, or Secondary Prevention).*

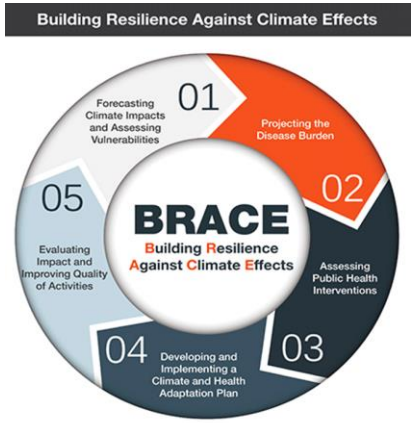
Goal and Generic Action	Suggested Strategies
Mitigation of climate change	
Carry out health impact assessment of mitigation strategies	Conduct epidemiologic research to estimate and document changes in health outcomes that result directly from mitigation actions
Limit the carbon (and other environmental) footprint related to the health care system	Design buildings, transport services, and facilities to achieve energy efficiency, in terms of energy sources and use, and to minimize waste
Enlist health professional organizations and government health departments	Educate the public about risks to health from climate change and explain that mitigating actions can confer additional, local health benefits
Include physicians and other health care workers as citizens	Participate in wider public discussion and moderate personal behaviors
Adaptation to lessen health risks	
Provide adequate health care facilities and services	Improve facilities for handling increased patient volume resulting from extreme weather events and ensure adequate stocks of vaccine
Anticipate necessary surge capacity (e.g., for major heat waves, fires, epidemics)	Coordinate with emergency-services agencies and ambulance facilities and consider morgue capacity
Reinforce and extend public health programs to provide a foundation for dealing with most types of climate-related health effects	Develop early-warning systems (e.g., for heat waves, floods, and possible epidemics); programs for infectious-disease surveillance and analysis, vaccination, and vector control (e.g., mosquitoes, ticks); support for vulnerable communities; and mental health services (e.g., for postevent trauma and depression)
Educate and train the health workforce	Develop programs that prepare health care workers to contribute to public education and to be on the alert for unexpected diagnoses
Engage in broader collaboration with other sectors	Institute policies for creating green spaces in cities (to promote physical and mental health); develop housing design and insulation to optimize health protection; consider livestock and wild animals as possible risks for infection

* The listed adaptation activities are intended to reduce health risks on the local and regional levels.

Public Health strategies to tackle Climate Change

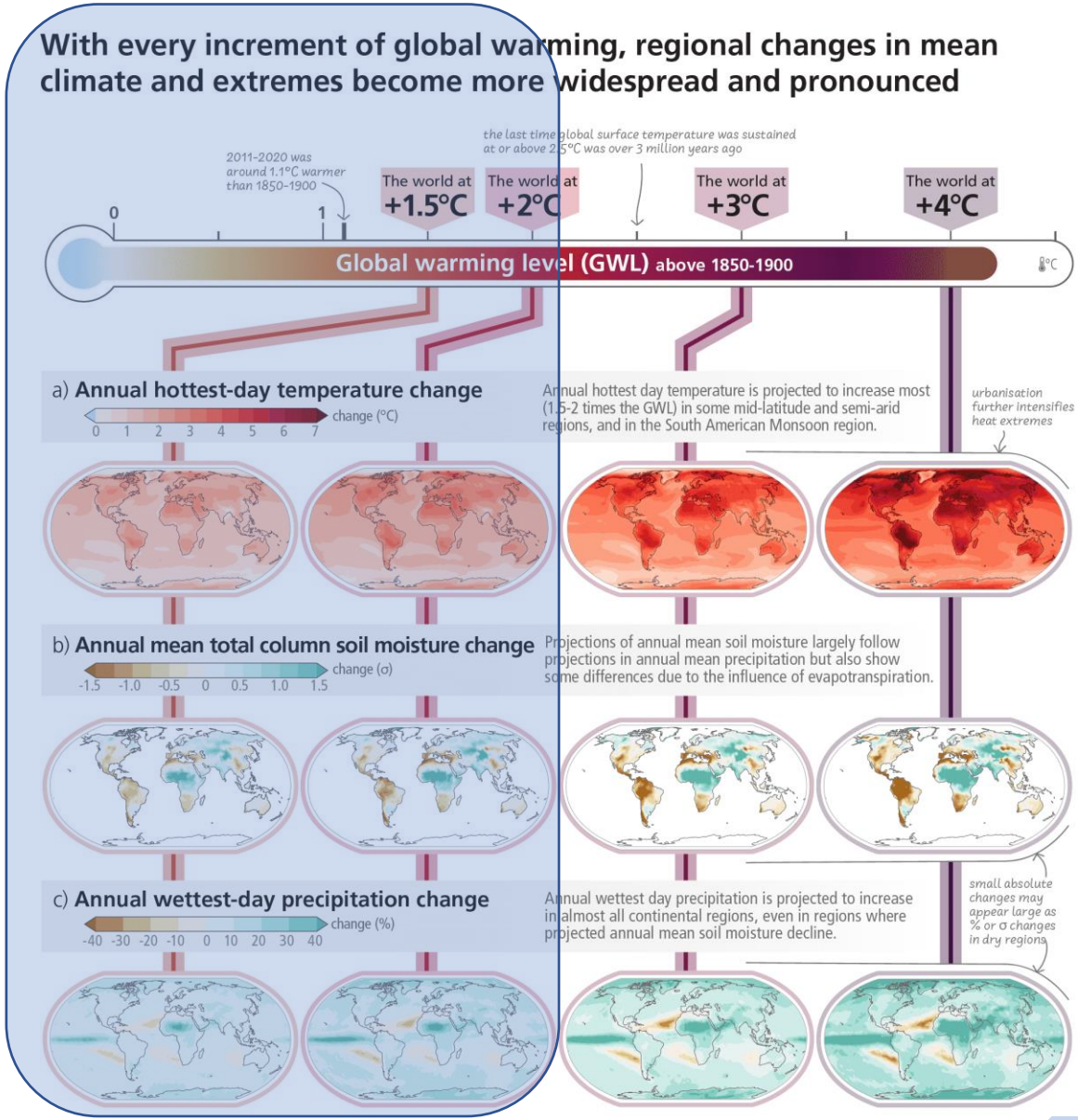
Health co-benefits of co-mitigation should not be underestimated





The world desperately needs to aim for a maximum of 2°C, if not 1.5°C, to ensure a degree of adaptation.

Past that, we enter a world of tipping points which are irreversible and detrimental to human life.



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Thank you