

Climate Disaster & Public Health

- The Climate Crisis is a Health Crisis -

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1. Climate disasters amplify disease, displace care, and destabilize health systems.

2. *Extreme weather is a public health emergency in disguise.*

3. Environmental collapse drives epidemics, malnutrition, and mental health crises.

Phase 3 lecture, 2024 - 2025

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Learning objectives

- *At the end of this lecture students will be able to* :
- Define the concept of “**Climate disaster**”
- Describe the concept of “**Public Health Disaster**”
- Understand mutual relationships between **Climate disaster & Public Health problems**
- Develop awareness and responsibility on emerging & re-emerging Public Health problems due to climate disaster
- Conceive the counter-measures how to tackle this global problem

Lecture Structure

- 1. Introduction: Framing climate as a health issue*
- 2. Disease threats** : Emerging, re-emerging diseases
- 3. Disease Burden, **DALY** / impact stats*
4. Rapid and longterm response & prevention strategies
- 5. Global policy overview (WHO, CDC, UN, UNEP, COP : Conference of the Parties)***
6. Conclusion & reminders, suggested further readings


What is climate change?

- ❖ **Climate change** is the long-term shift in global and local weather patterns primarily caused by carbon emissions and the greenhouse effect.
- ❖ *It encompasses more than just the rise in the Earth's surface temperatures known as **global warming**.*
- ❖ Together with global warming, climate change also includes, for ex. alterations in precipitation, cloud patterns, and sea levels.

What is climate change?

- ❖ While there are natural causes of climate change, the majority of climate change since the 19th century has been driven by humans.
- ❖ *Despite this, climate misinformation persists, with some climate skeptics attributing most, if not all, climate alterations to natural phenomena.*
- ❖ To get a better understanding of what's really behind climate change, let's examine 3 of its primary causes and effects.

What is climate change?

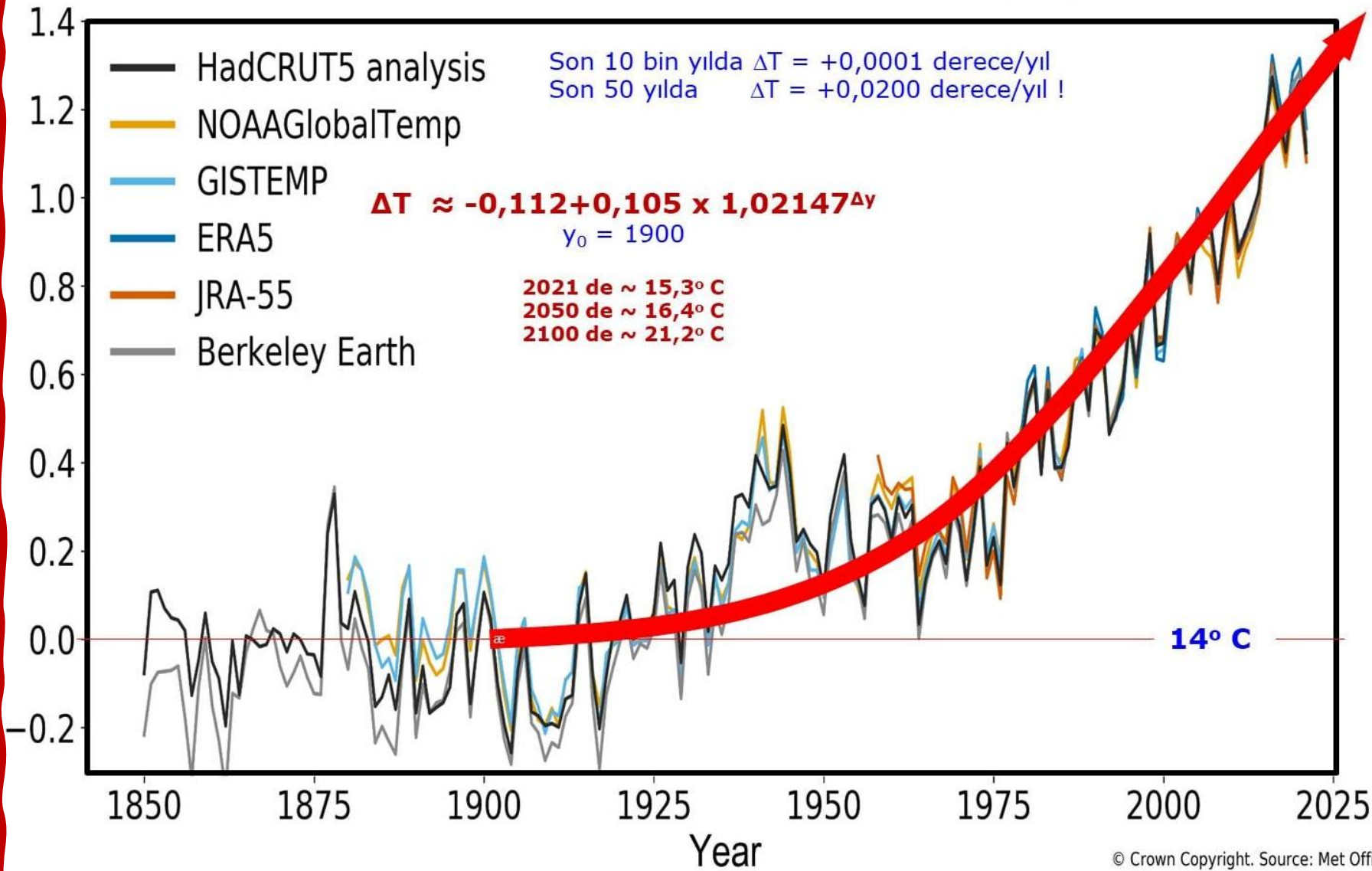


Climate Change
[ˈkliːmət ˈtʃɑːnʃ]
The long-term shift in global and local weather patterns primarily caused by carbon emissions and the greenhouse effect.

What are the causes of climate change?

Here are three large contributors to climate change, all of which are interlinked with the *greenhouse effect* :

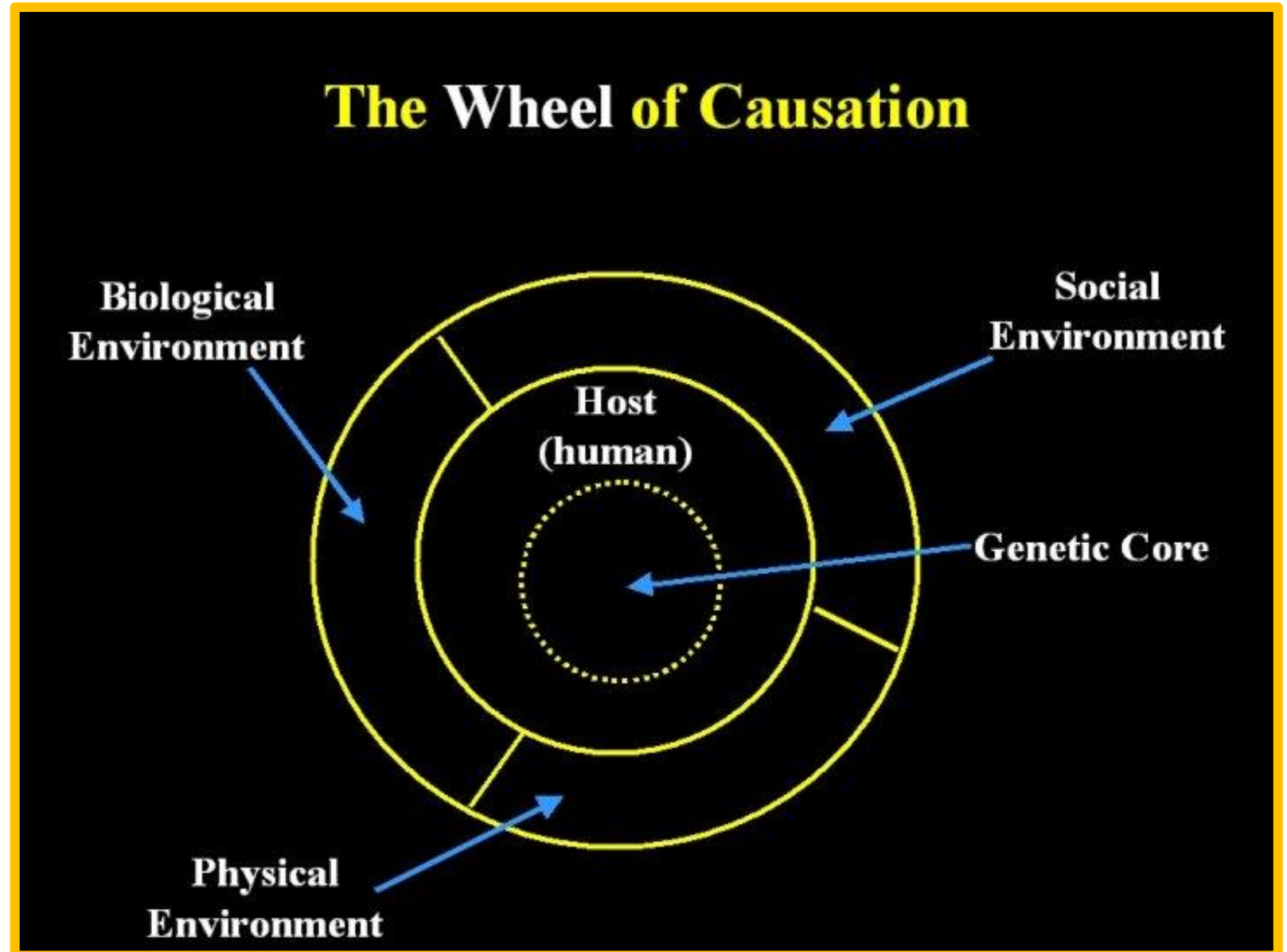
Global mean temperature difference from 1850-1900 (° C)



Biodiversity is continuously being lost by global warming..

Health Problems & Environment

*When
Nature
Rebels,
Health
Retreats.*



Key facts for climate change-1

- **Climate change** is directly contributing to humanitarian emergencies from heatwaves, wildfires, floods, tropical storms and hurricanes and they are increasing in scale, frequency and intensity.
- *Research shows that 3.6 billion people already live in areas highly susceptible to climate change.*
- Between 2030-50, climate change is expected to cause approx. 250 000 additional deaths per year, from ***undernutrition, malaria, diarrhoea and heat stress*** alone.

Key facts for climate change-2

- The direct damage costs to health : Excluding costs in health-determining sectors such as agriculture and water and sanitation is estimated to be between US\$ 2-4 billion a year by 2030.
- Areas with weak **health infrastructure** -mostly in developing countries- will be the least able to cope without assistance to prepare and respond.*
- Reducing emissions of **greenhouse gases** through better transport, food and energy use choices can result in very large gains for health, particularly through reduced **air pollution**.

What are the causes of climate change?

1. Food production and agriculture:

The agricultural sector is one of the biggest overall emitters of [carbon emissions](#) and the [largest emitter of methane \(CH₄\)](#). When emitted, carbon compounds such as methane trap heat in the atmosphere and are one of the biggest drivers of **global warming**, leading to countless subsequent issues.

*Protect
the planet
to protect
our health*



<https://www.ecolife.com/dictionary/climate-change> 13.4.25

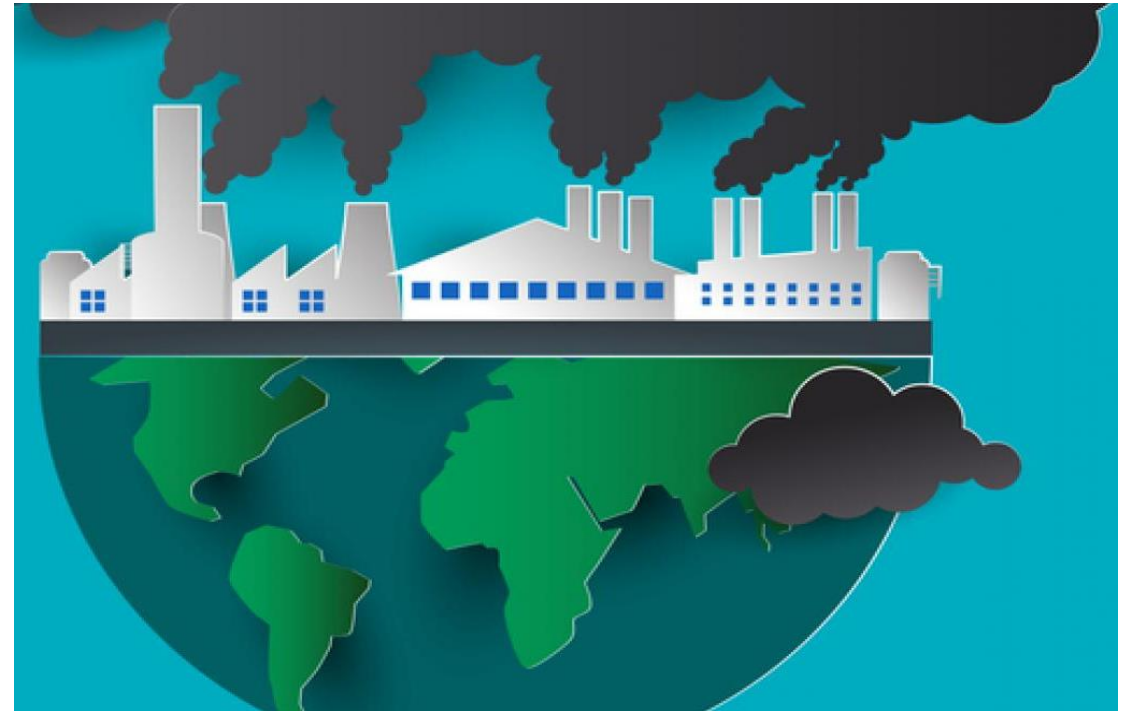
What are the causes of climate change?

2.Fossil fuels :

The process of creating electricity to power our homes, transport us around, and produce our goods relies heavily on burning *fossil fuels*.

This process is the biggest emitter of carbon dioxide (CO₂) emissions worldwide and energy continues to be one of the key challenges in fighting climate change.

*A heating world
is a sickening
world; act now!*



<https://www.ecolife.com/dictionary/climate-change> 13.4.25

What are the causes of climate change?

3. Forest degradation and deforestation:

Forests regulate the climate by capturing and converting vast amounts of carbon compounds.

By cutting down our forests, we are not only robbing our planet of its carbon sinks but also helping release previously stored carbon back into the atmosphere.

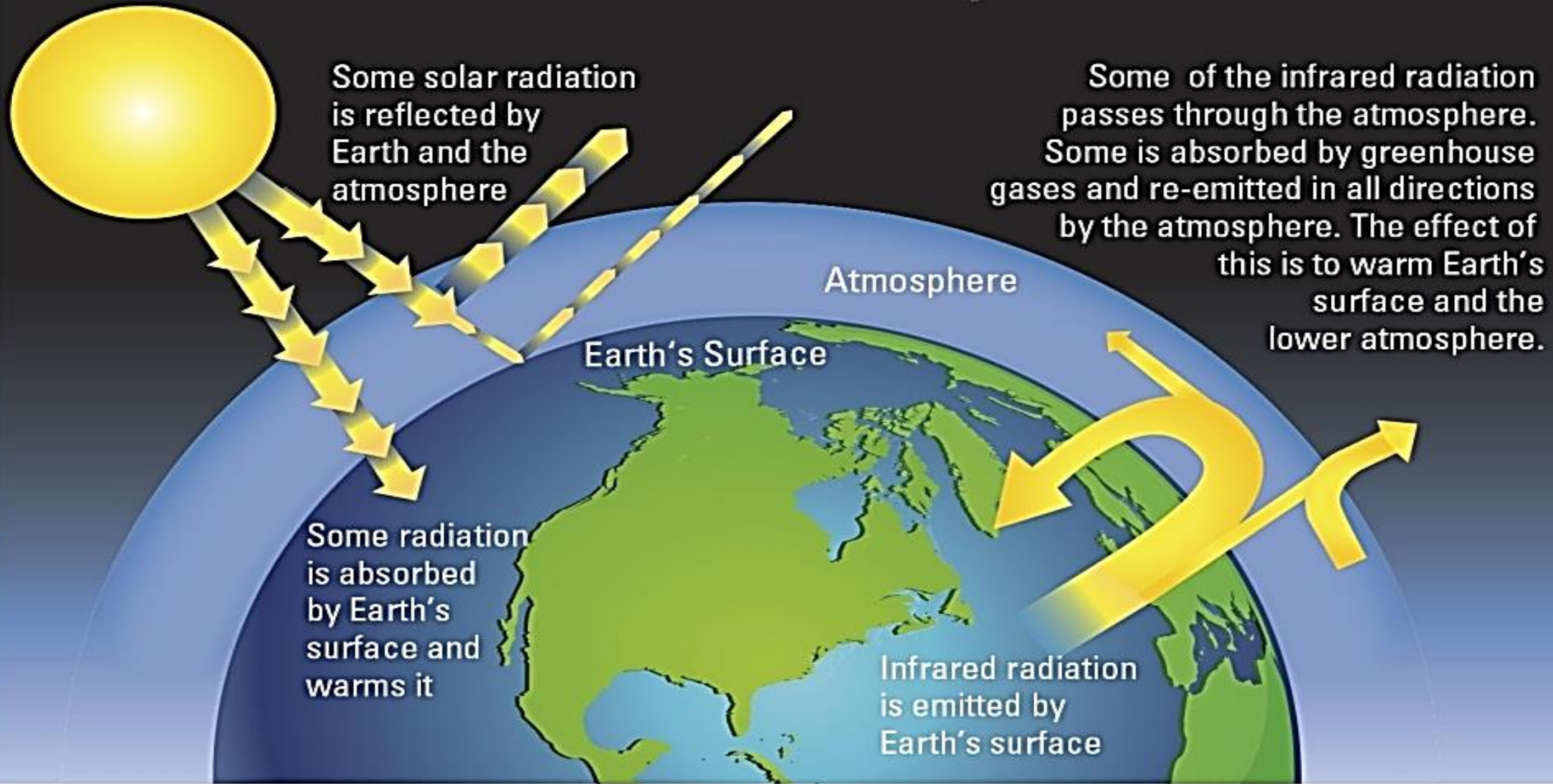
Furthermore, **loss of forests** destroys biodiversity, disrupts water cycles, and leads to soil erosion.

*In Solidarity
for a
Green World*



<https://www.ecolife.com/dictionary/climate-change> 13.4.25

THE GREENHOUSE EFFECT



IPCC - Intergovernmental Panel on Climate Change



The Intergovernmental Panel on Climate Change

is an intergovernmental body of the **United Nations**.

Its job is to «*provide governments at all levels with scientific information that they can use to develop climate policies.*»



What is Public Health Disaster?

- ❖ A **public health disaster** is any event that seriously threatens the health of a large population and overwhelms the capacity of health systems to respond effectively.
- ❖ A **public health disaster** is a **sudden or prolonged event** that causes **widespread health harm** to a population, **overwhelms health systems**, and often requires *emergency public health interventions*.
- ❖ It demands rapid, large-scale **public health actions** to reduce suffering, disease, and death.
- ❖ Large numbers of people are **injured, infected**, or at risk.
- ❖ May include deaths, chronic illnesses, mental health problems or disability.

What is Public Health Disaster?

- **Disruption of Public Health Infrastructure**
- *Hospitals, clinics, water supply, sanitation, or disease surveillance systems may collapse or become ineffective.*
- **Requires Emergency Response**
- *Government, NGOs, and international aid may be called in.*
- **Vaccinations**, mass evacuations, or quarantines may be necessary.
- ***Rapid or Escalating Spread***
- Often includes ***infectious disease outbreaks*** (e.g. cholera, COVID-19), toxic exposures, or displacement-linked **epidemics**.

Examples of Public Health Disaster?

Type	Examples
Natural	Earthquakes, floods, droughts → leading to waterborne diseases, malnutrition, injury
Biological	<i>Epidemics and pandemics (e.g. Ebola, COVID-19)</i>
Technological	Chemical spills (e.g. Bhopal gas tragedy), nuclear accidents (e.g. Chernobyl, Fukushima..)
Conflict-related	<i>Refugee crises, collapsed healthcare in war zones</i>
Climate-linked	Heatwaves, wildfires, vector-borne disease outbreaks

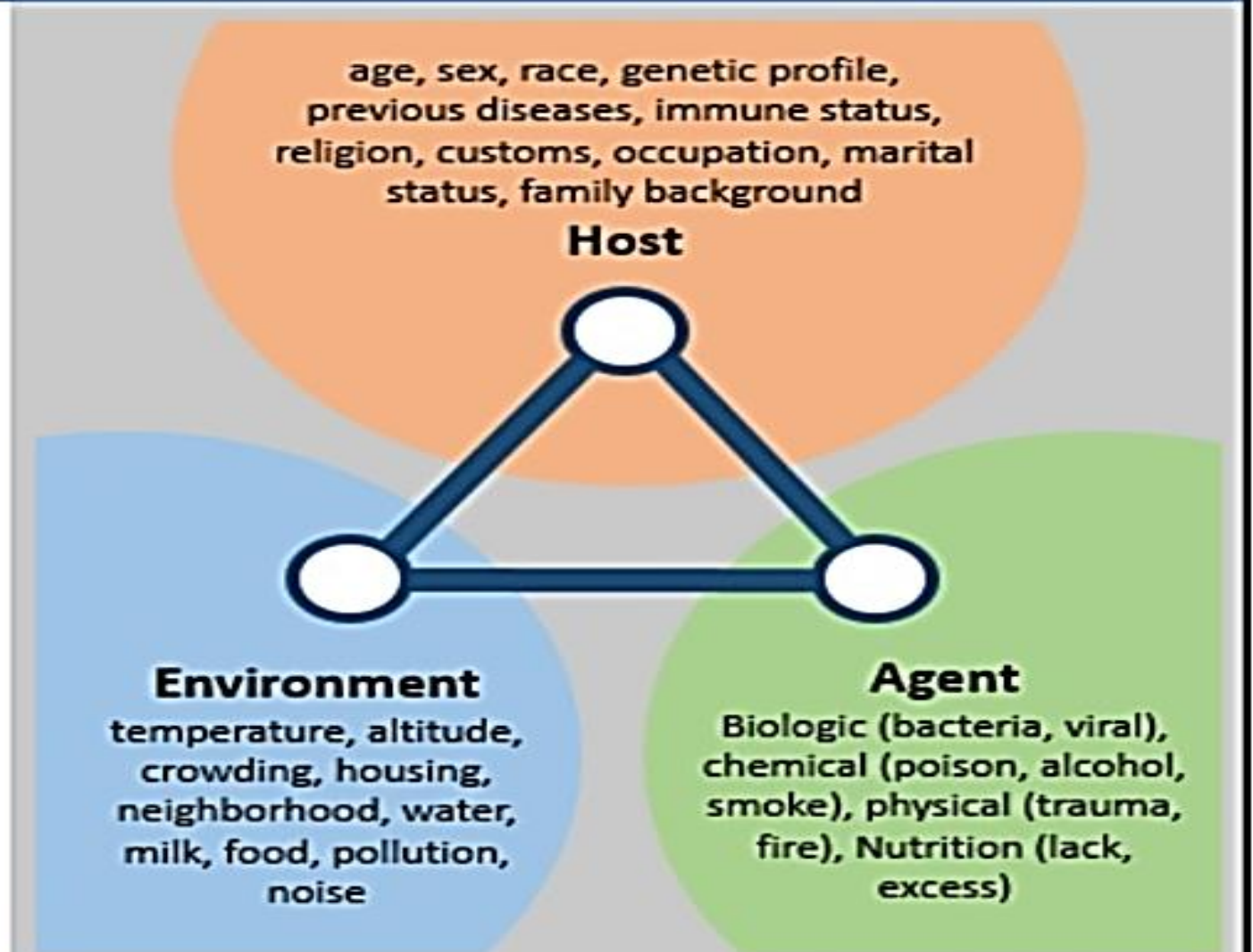
Public Health Response Includes

- Disease surveillance
- *Risk communication*
- Access to clean water and food
- *Mental health support*
- Medical aid, vaccines, sanitation
- *Coordinated international aid*



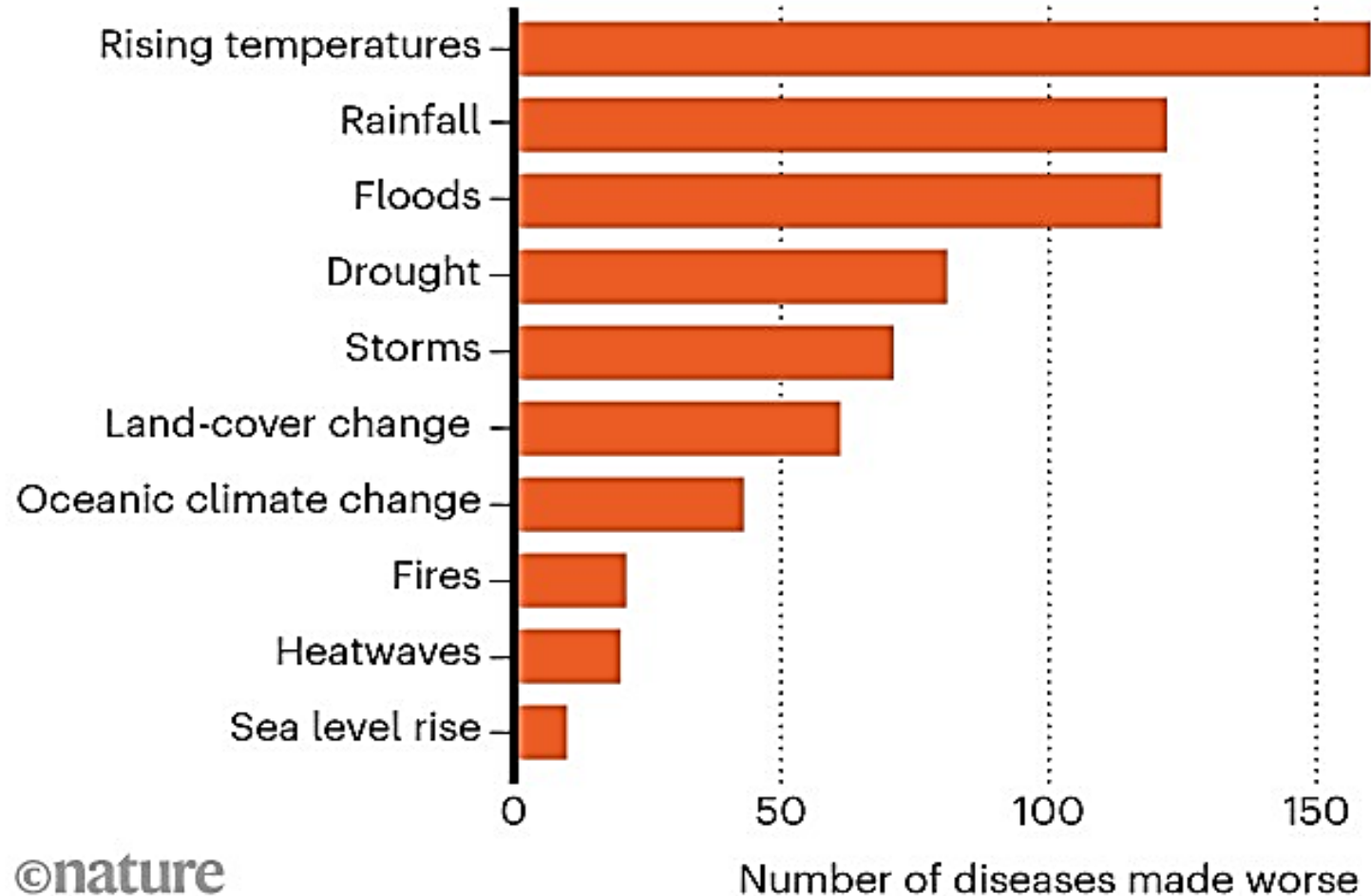
Epidemiological Triangle

- Basic model to study health problems
- 3 factors
 - Host
 - Environment
 - Agent
- Disease is produced by exposure of a susceptible **host** to an noxious **agent** in the presence of **environmental factors** that aid or hinder agents of disease

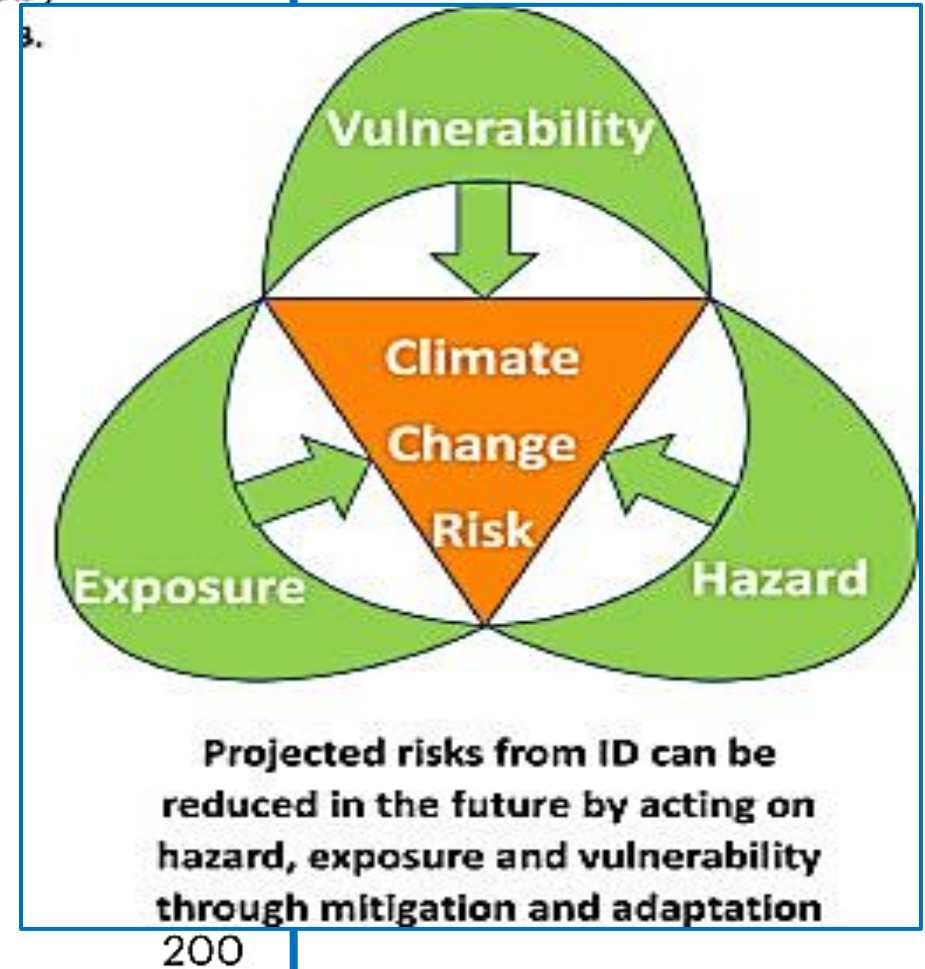


CLIMATE HAZARDS EXACERBATE DISEASES

Rising temperatures pose the greatest threat to disease outbreaks. For instance, warmer temperatures increased mosquito survival and biting rates, thereby increasing the spread of West Nile virus.



©nature



Health – the limit of human tolerance

- ❖ **Climate change** adversely affects both the physical and the mental health of people in all regions of the world.
- ❖ *Severe **mental health** challenges are reported mainly by people who have been exposed to extreme weather events or by rescue workers deployed during such events,*
- ❖ and by people who have suffered loss of livelihoods or even their homes, communities or culture as a result of climate change.
- ❖ *Physical health is adversely affected primarily by extreme heat.*
- ❖ Rising air temperatures and longer and more intense **heatwaves** have increased the occurrence of **diseases** and led to **higher mortality** worldwide, including in the middle latitudes.

https://worldoceanreview.com/en/wor-8/urgently-sought-ways-out-of-the-climate-crisis/code-red-for-people-and-nature/?gad_source=1&gclid=CjwKCAjwwe2_BhBEEiwAM1I7sRbU91Dx0SKy02XtXzIOT_XhxsDHu4NwBMIGy_fF9Ag1Ttu8YWoO-hoCwf0QAvD_BwE 14.4.25

Health – the limit of human tolerance

- ❖ The **elderly**, people with medical conditions and outdoor workers are particularly impacted.
- ❖ Additionally, for this latter group, warming is often associated with loss of earnings if extreme heat makes outdoor labour in fields or on construction sites impossible.
- ❖ **Extreme heat** is particularly hazardous when it is compounded by very high **humidity**. If the air is so humid that water and therefore also sweat cannot evaporate, the human body's cooling mechanism begins to fail.
- ❖ As a result, the body steadily overheats, ultimately causing **circulatory collapse** and in extreme cases, **fatal heat stroke**.

https://worldoceanreview.com/en/wor-8/urgently-sought-ways-out-of-the-climate-crisis/code-red-for-people-and-nature/?gad_source=1&qclid=CjwKCAjwwe2_BhBEEiwAM1I7sRbU91Dx0SKy02XtXzlOT_XhxsDHu4NwBMIGy_fF9Aq1Ttu8YWoO-hoCwf0QAvD_BwE 14.4.25

Health – the limit of human tolerance

- ✓ The human **heat tolerance** limit can be determined using the cooling limit temperature.
- ✓ *This captures both ambient temperature and humidity.*
- ✓ Until recently, it was assumed that a healthy individual cannot survive a cooling limit temperature of 35 degrees Celsius for more than around six hours.
- ✓ *This limit is derived from the combination of temperature and humidity and corresponds to 35 degrees Celsius at 100 % humidity or 46 degrees Celsius when humidity is 50 %*

https://worldoceanreview.com/en/wor-8/urgently-sought-ways-out-of-the-climate-crisis/code-red-for-people-and-nature/?gad_source=1&qclid=CjwKCAjwwe2_BhBEEiwAM1I7sRbU91Dx0SKy02XtXzLOT_XhxsDHu4NwBMIGy_fF9Aq1Ttu8YWoO-hoCwf0QAvD_BwE 14.4.25

Duration of hyperthermia periods due to extreme heat and humidity



https://worldoceanreview.com/en/wor-8/urgently-sought-ways-out-of-the-climate-crisis/code-red-for-people-and-nature/?gad_source=1&qclid=CjwKCAjwwe2_BhBEEiwAM1I7sRbU91Dx0SKy02XtXzLOT_XhxsDHu4NwBMIGy_fF9Aq1Ttu8YWoO-hoCwf0QAvD_BwE 14.4.25

The WMO's 7 Global Climate Indicators

- ✓ *Global mean surface temperature,*
- ✓ Ocean heat content,
- ✓ *Global mean sea-level change,*
- ✓ Arctic and Antarctic **sea-ice** extent,
- ✓ *Changes in the mass balance of the Greenland and Antarctic Ice Sheets,*
- ✓ Global mean ocean pH (*ocean acidification*) & Mean atmospheric CO2 concentrations.



Continued ice-mass loss for the Greenland and Antarctic Ice Sheets

https://worldoceanreview.com/en/wor-8/urgently-sought-ways-out-of-the-climate-crisis/code-red-for-people-and-nature/?gad_source=1&qclid=CjwKCAjwwe2_BhBEEiwAM1I7sRbU91Dx0SKy02XtXzLOT_XhxsDHu4NwBMIGy_fF9Aq1Ttu8YWoO-hoCwf0QAvD_BwE 14.4.25

**10
minutes**

***“Education is love, setting a good example;
nothing else.”***

**Swiss Johann Heinrich Pestalozzi,
one of the pioneers of modern education:**





Smoke rises from the chimneys of a steel works in Mongolia. Meanwhile, ore is smelted illegally by workers at a nearby camp. China is the world's largest emitter of CO₂ (*accounting for around 30 % of global emissions in 2022*), partly because coal is still the country's main energy source.

Cyclone Idai

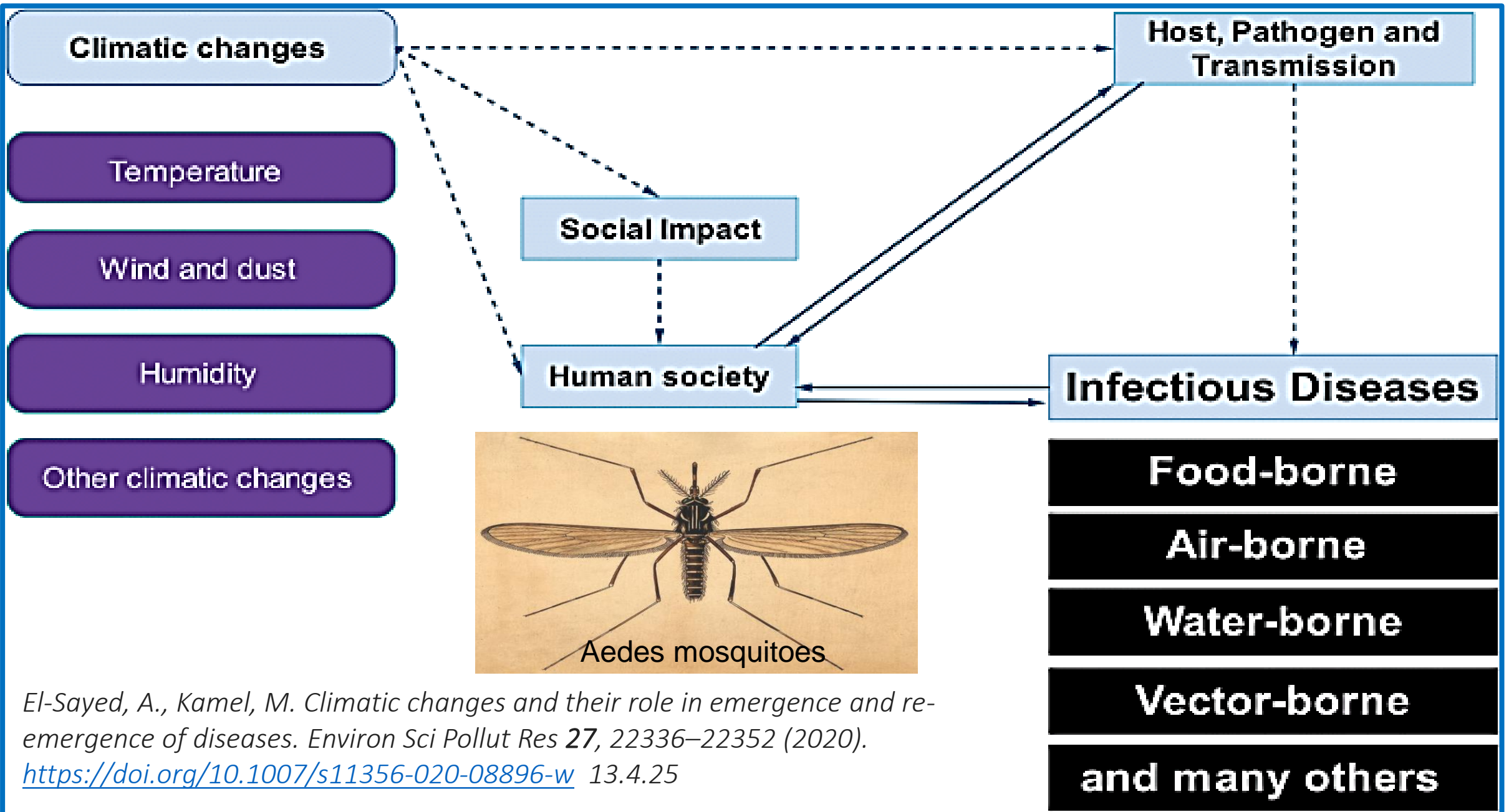
Thousands displaced in Central Mozambique

Tropical Cyclone Idai made landfall near Beira City near Mozambique in the early hours of 15 March 2019, leaving extensive destruction in its wake.

The system also brought heavy rains and flooding to **Mozambique, Zimbabwe and Malawi**.

The UN Office for the Coordination of Humanitarian Affairs estimates that a total of **1.6 million people have been affected** in the three countries. WHO is supporting the health response by deploying staff, dispatching medicines and strengthening disease detection and response in affected areas.

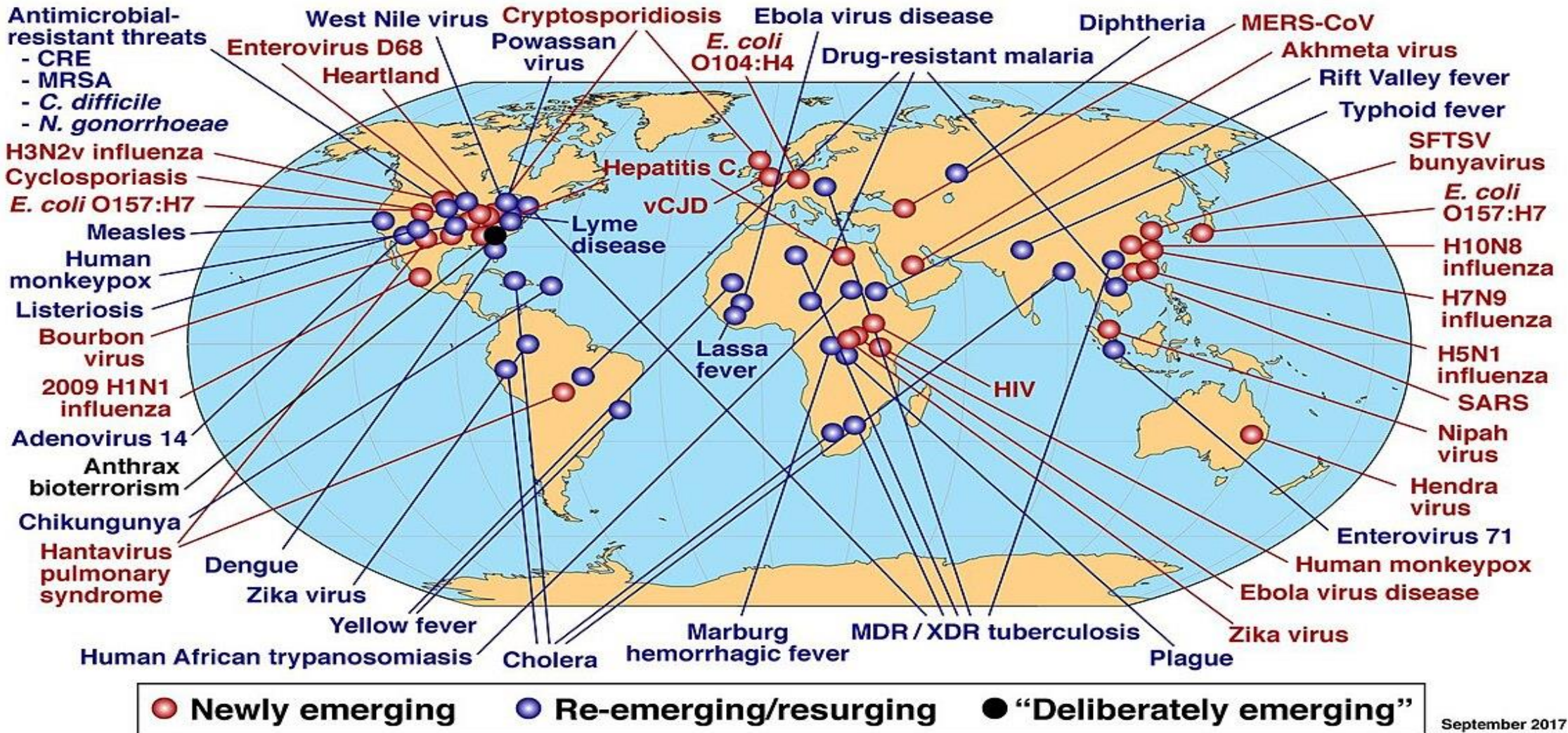




El-Sayed, A., Kamel, M. Climatic changes and their role in emergence and re-emergence of diseases. *Environ Sci Pollut Res* **27**, 22336–22352 (2020).

<https://doi.org/10.1007/s11356-020-08896-w> 13.4.25

Global Examples of Emerging and Re-Emerging Infectious Diseases

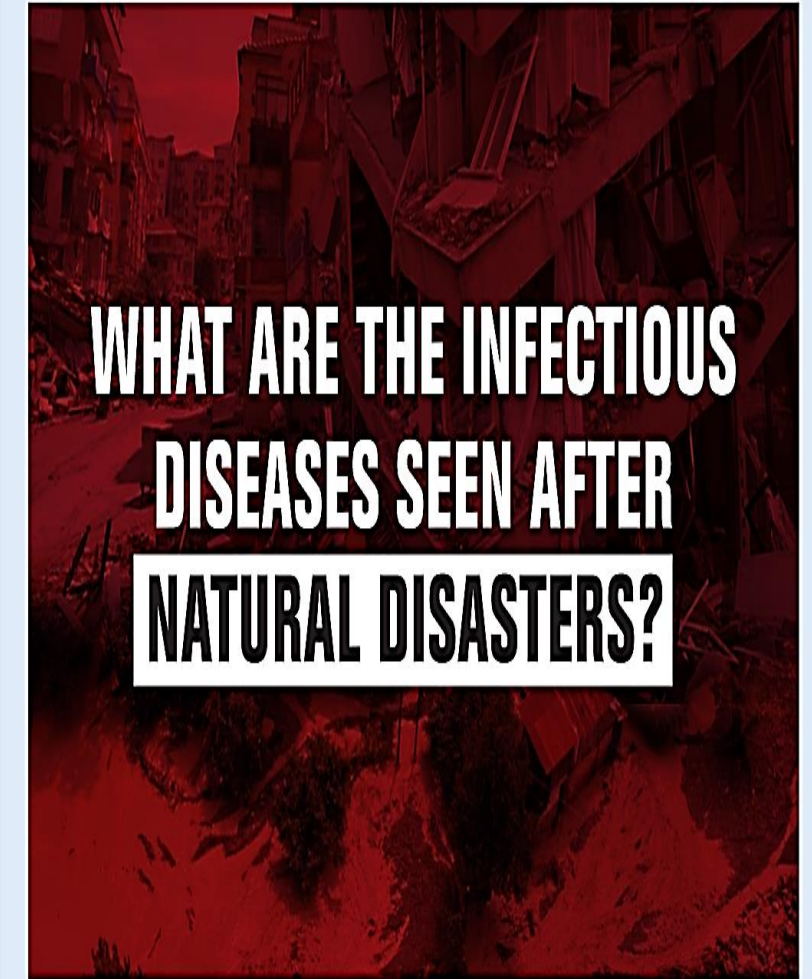


Major Public Health Threats from Climate Disasters

- **Heat-related illnesses and deaths** :
e.g., heat stroke, cardiovascular strain)
- ***Vector-borne diseases*** : e.g., malaria, dengue, Lyme disease
- **Respiratory diseases** : e.g., asthma, **COPD** due to wildfire smoke, air pollution
- ***Water-borne diseases*** : e.g., cholera, leptospirosis
- Food insecurity & malnutrition
- ***Mental health impacts*** : e.g., anxiety, **PTSD** after disasters
- Disruption of health services and infrastructure
- Population displacement and ***climate migration***

Major Emerging Diseases from Climate Disasters

- **Zoonotic spillovers** : Due to changing animal-human interactions, Nipah, Ebola-like viruses
- **Arboviruses in new regions** : *Chikungunya, Zika in Europe*
- **Fungal infections** : *Valley fever* expanding due to drier, dustier conditions
- **AMR-Antimicrobial-resistant infections** : *Worsened by flooding and poor sanitation*



Major Re-Emerging Diseases from Climate Disasters

- **Malaria** in previously eradicated zones (due to warmer temperatures)
- **Dengue fever** resurgence
- **Cholera** and diarrheal diseases after flooding or drought
- **Leptospirosis** following flooding
- **Tuberculosis** in displaced populations due to overcrowding and weakened health systems



WHO – Climate Change & Public Health

- WHO identifies climate change as the **greatest threat** to global health in the 21st century.
- Focuses on:
 - *Surveillance systems*
 - *Climate-resilient health systems*
 - *Urban health strategies*
 - *Integrating health into climate policy*
- Flagship publication: “**COP26 Special Report on Climate Change and Health**”

[WHO Climate & Health page](#)



CDC : Climate Change & PH

- Focus on **U.S.-specific vulnerabilities**.
- Maintains the ***Climate & Health Program***.
- **Key priorities** :
 - Heat stress
 - Vector-borne diseases: West Nile Virus
 - Wildfire smoke and air quality
 - Tracking via **BRACE framework** :
Building Resilience Against Climate Effects

 [CDC Climate & Health page](#)

*Climate change, together with other natural and human-made health stressors, influences human health and disease in numerous ways. Some existing health threats will intensify and **new health threats** will emerge. Not everyone is equally at risk. Important considerations include age, economic resources, and location.*

FAO



COP29



Food and Agriculture
Organization of the
United Nations

Climate change

FAO : Climate Change & Public Health

- The Food and Agriculture Organization (FAO) of the United Nations considers *climate-related disasters* a **significant threat to global food security and agricultural sustainability**.
- **Disproportionate Impact on Agriculture:** Agriculture bears a substantial share of disaster-related damages, with approximately 63% of disaster impacts affecting this sector.
- Between 2008-2018, developing countries experienced over \$108 billion in **losses in crop and livestock** production due to natural disasters.

FAO's work on climate change

- Climate change threatens our ability to ensure global food security, eradicate poverty & achieve sustainable development.
- *In 2016, 31 % of global emissions originating from human activity came from agrifood systems.*
- This includes **deforestation**, livestock production, soil and nutrient management, and food loss and waste.
- *The increasing concentrations of greenhouse gases are trapping more heat in the atmosphere, which causes global warming.*

FAO's work on climate change

- Climate change has both direct and indirect impacts on agrifood systems due to shifting and unpredictable rainfall patterns and temperatures, a higher incidence of extreme weather events and ***disasters such as drought, floods, outbreaks of pests and disease and ocean acidification.***
- FAO is supporting countries to adapt to climate change and to mitigate climate change by reducing or ***preventing greenhouse gas emissions***, through its projects and programmes and a wide range of knowledge products.

UNEP : Climate Change & Public Health

- Emphasizes **ecosystem-health-human health nexus**.
- Advocates for:
 - Pollution reduction
 - **Renewable energy** transitions
 - **Sustainable food** systems
- Promotes **One Health approach**:
links human, animal, and environmental health.



 UNEP & Health

UNEP : Climate Change & Public Health

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links human, animal, and environmental health.



 UNEP & Health

UN : Climate Change & Public Health

- Integrates climate health impact within **SDG 3 (Good Health and Well-being)** and **SDG 13 (Climate Action)**.
- Hosts major platforms like **UN Climate Change Conference (COP)**.
- Focus on **equity, climate justice, and adaptation finance** for health systems.

 [UN Climate & Health](#)

- 2003 European **heatwave** :
70K excess deaths
- **Cyclone** Idai in Mozambique (2019)
- Pakistan **floods** (2022): Link to cholera outbreaks

Key Public Health Countermeasures

- Strengthen disease **surveillance** systems
- *Climate-resilient healthcare infrastructure*
- Integrated **early-warning systems** for extreme weather and disease outbreaks
- **Vaccination** programs for at-risk populations
- Water, sanitation, and hygiene (**WASH**) improvements
- *Cross-sectoral emergency preparedness :
Health, transport, urban planning*
- **Community education & risk communication**



Renewable energy sources instead of fuel



Statistical Data & DALY Burden

- According to **WHO**, climate change is expected to cause approximately **250,000 additional deaths per year** between 2030 and 2050 from:

- **Heat exposure**: ~38,000 DALY

- **Diarrhea**: ~48,000 DALY

- **Malaria**: ~60,000 DALY

- Childhood **undernutrition**: ~95,000 DALY burden:

- In 2019, over 12.6 million deaths annually are attributed to environmental factors, many linked to **climate change** (WHO).

- **Climate-related health issues** contribute significantly to non-communicable diseases DALYs (*cardiovascular, respiratory*) due to **air pollution**.



Latest IPCC Climate Report Highlights-1

- ❑ The Intergovernmental Panel on Climate Change (**IPCC**) released its Sixth Assessment Report (AR6) Synthesis Report in March 2023, summarizing key findings from the previous five years: [IPCC](#)
- ❑ **Global Warming Threshold:** *There is a more than 50% chance that global temperatures will rise by 1.5°C above pre-industrial levels between 2030-2050.* [World Resources Institute](#)
- ❑ **Climate Impacts:** Climate change is already causing widespread and severe impacts, including more frequent and intense **heatwaves, droughts, and floods.** [IPCC](#)
- ❑ **Emission Reductions:** *To limit warming to **1.5°C**, global greenhouse gas emissions need to be halved by 2030.* [World Economic Forum](#)

SHAPING
OUR
FUTURE
TOGETHER



Latest IPCC Climate Report Highlights-2

- ✓ **Adaptation and Resilience:**
- ✓ While adaptation measures are being implemented, they are often insufficient, and increased investment is needed to enhance resilience, especially in *vulnerable regions*. [IPCC](#)
- ✓ **Irreversible Changes:**
- ✓ Exceeding the **1.5°C threshold**, even temporarily, could lead to **irreversible impacts** on ecosystems and human societies. [World Economic Forum](#)
- ✓ The report underscores the **urgent need** for comprehensive and **immediate climate action** to mitigate the most severe consequences of climate change.

Take-Home Reminders-1

- ✓ ***The climate crisis is a health crisis;*** Planetary health = Public health
- ✓ **Climate disaster** affects every aspect of public health.
- ✓ Heat, vector-borne diseases, and respiratory illness are on rise.
- ✓ **Climate Disaster** disproportionately affect the most vulnerable.
- ✓ Vulnerable populations are hit hardest.
- ✓ *Heat, vectors, and water extremes are key drivers of disease.*
- ✓ **Health systems** must adapt with resilience and early warning.
- ✓ *You are part of the solution; advocate, educate, and prepare.*
- ✓ **Prevention and preparedness save lives.**

Take-Home Reminders-2

- ✓ You have a role; clinician, advocate, educator, public health carer.
- ✓ Heatwaves are silent killers, **be alert**.
- ✓ **Mosquitoes** are moving North, so are their diseases.
- ✓ **Floods spread** not just water, but **infection**.
- ✓ Disasters weaken **health systems**, resilience is key.
- ✓ Learn : Follow WHO, UNEP, CDC, COP, IPCC updates.
- ✓ Prepare : Advocate for climate-resilient **healthcare**.
- ✓ Collaborate : Climate action needs **all sectors**.
- ✓ Act : What you do today defines **tomorrow's health**.
- ✓ Ask : Is this disease climate-linked?



Conclusion-1

- ❑ Climate disaster is not a distant threat.
- ❑ *It's a current, accelerating crisis re-shaping global health.*
- ❑ As future medical professionals, your role is critical:
- ❑ *To understand, anticipate, and respond to these intertwined threats.*
- ❑ Climate action is health action!
- ❑ *And building resilience now is the only cure for what may otherwise become an overwhelming **public health emergency**.*
- ❑ **Reducing population growth rate is an absolute mandate.**



Conclusion-2

- ❖ Climate disaster is not a distant threat; it's a current, accelerating.
- ❖ “Climate disasters are not just environmental phenomena, they are ***escalating public health emergencies*** .
- ❖ From **heatwaves** to **hurricanes**, from **malaria** to **malnutrition**, every extreme event reveals how ***vulnerable human health*** is to **ecological collapse** .
- ❖ **As future physicians, your responsibility extends beyond hospitals:**
- ❖ *You are part of the **climate-health response**.*
- ❖ Understanding these risks equips you not only to treat, but to prevent and to advocate for healthier, more resilient communities.

Conclusion-3

- We can no longer separate planetary health from **human health**.
- *Every degree of **warming** means more suffering, particularly for the world's poorest and most vulnerable.*
- But there is hope through knowledge, preparedness, and action, we can mitigate the damage.
- ***Your role is critical:*** As the next generation of medical professionals, *You are not just caregivers, Climate change – a risk multiplier*
- You are guardians of health in a changing climate.
- **Everyone, has to minimize his/her carbon footprint; go green!**
- ***Humanity should get rid of capitalistic-imperialist inhuman order.***

Suggested Readings

- ✓ WHO: *COP26 Special Report on Climate Change and Health*
- ✓ The Lancet Countdown on Health and Climate Change
- ✓ UNEP: *Healthy Planet, Healthy People*

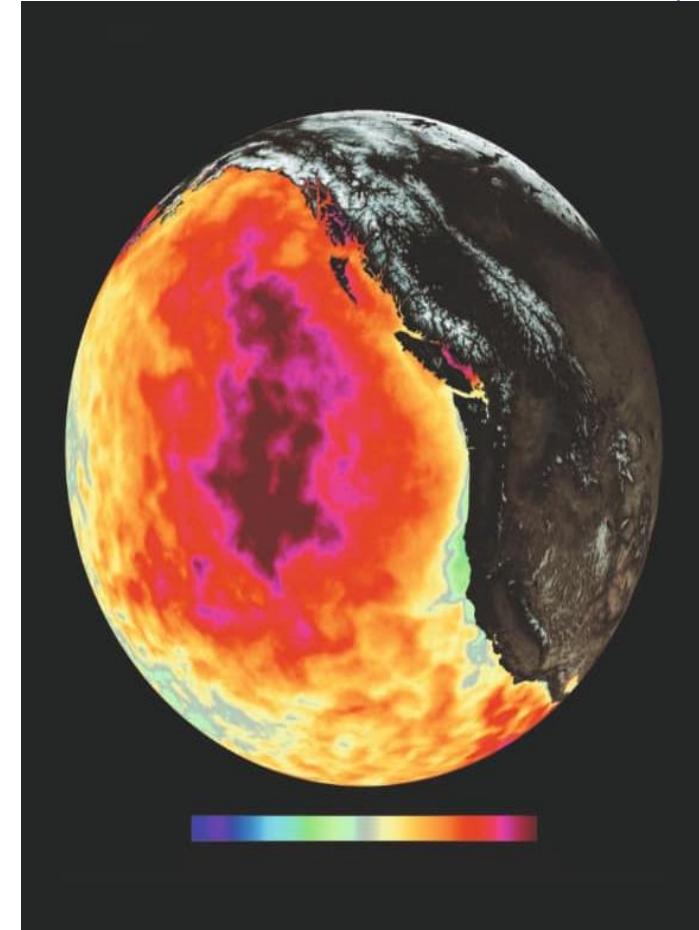
Interactive Visuals

- DALY heat maps by climate-sensitive diseases
- WHO infographic: “Climate Change and Health: 10 Facts”
- IPCC health impact diagrams



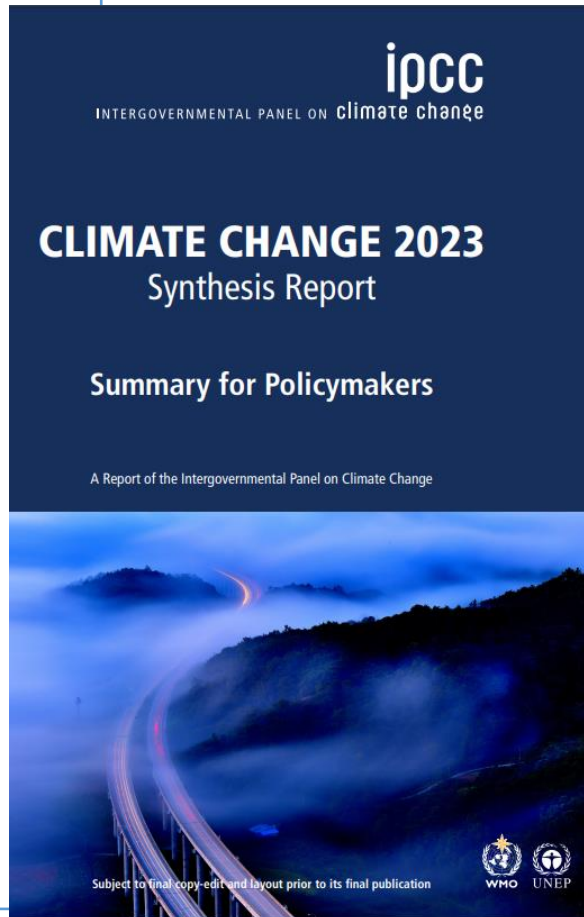
Supplementary Media

- WHO Video: “*Why Climate Change is a Health Issue*”
- TED Talk: “*What the climate crisis means for your health*” – Dr. Cheryl Holder



The most recent **UN Climate Change Conf., COP29**, was held from November 11 to 22, 2024, in Baku, Azerbaijan. This conference brought together nearly 200 countries to advance global climate action.

[UNFCCC+3Wikipedi+3The Nature Conservancy+3AP News+3The Nature Conservancy+3Wikipedi+3](#)



Key Outcomes from COP29

- Climate Finance:** An agreement was reached to increase climate financing for developing nations from \$100 billion to \$300 billion annually by 2035. However, this falls short of the estimated \$1.3 trillion per year needed to adequately address climate challenges. [The Verge+1The Guardian+1](#)
 - Carbon Credit Trading:** The conference established rules and a UN registry to facilitate and record international carbon credit trading, aiming to support global emissions reduction efforts. [Wikipedi+1Wikipedi+1](#)
 - Fossil Fuel Transition:** For the first time, a COP agreement explicitly called for a transition away from all fossil fuels. However, the language used was non-binding, leading to criticism from climate-vulnerable nations and advocacy groups. [The Guardian+2Wikipedi+2The Verge+2](#)
 - Nuclear Energy:** Six additional countries, including Turkey, joined a pledge to triple global nuclear energy capacity by 2050, reflecting growing interest in nuclear power as part of the clean energy transition. [The Guardian](#)
- Despite these developments, COP29 faced criticism for the significant presence of fossil fuel lobbyists and perceived insufficient commitments to phase out fossil fuels.

***1 child for 1 family!
Urgent must..***



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Thank you for joining..