Health Effect of Climate change

Presented by

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Ms in:

Epidemiology

PhD in:

Health in Disaster and Emergencies

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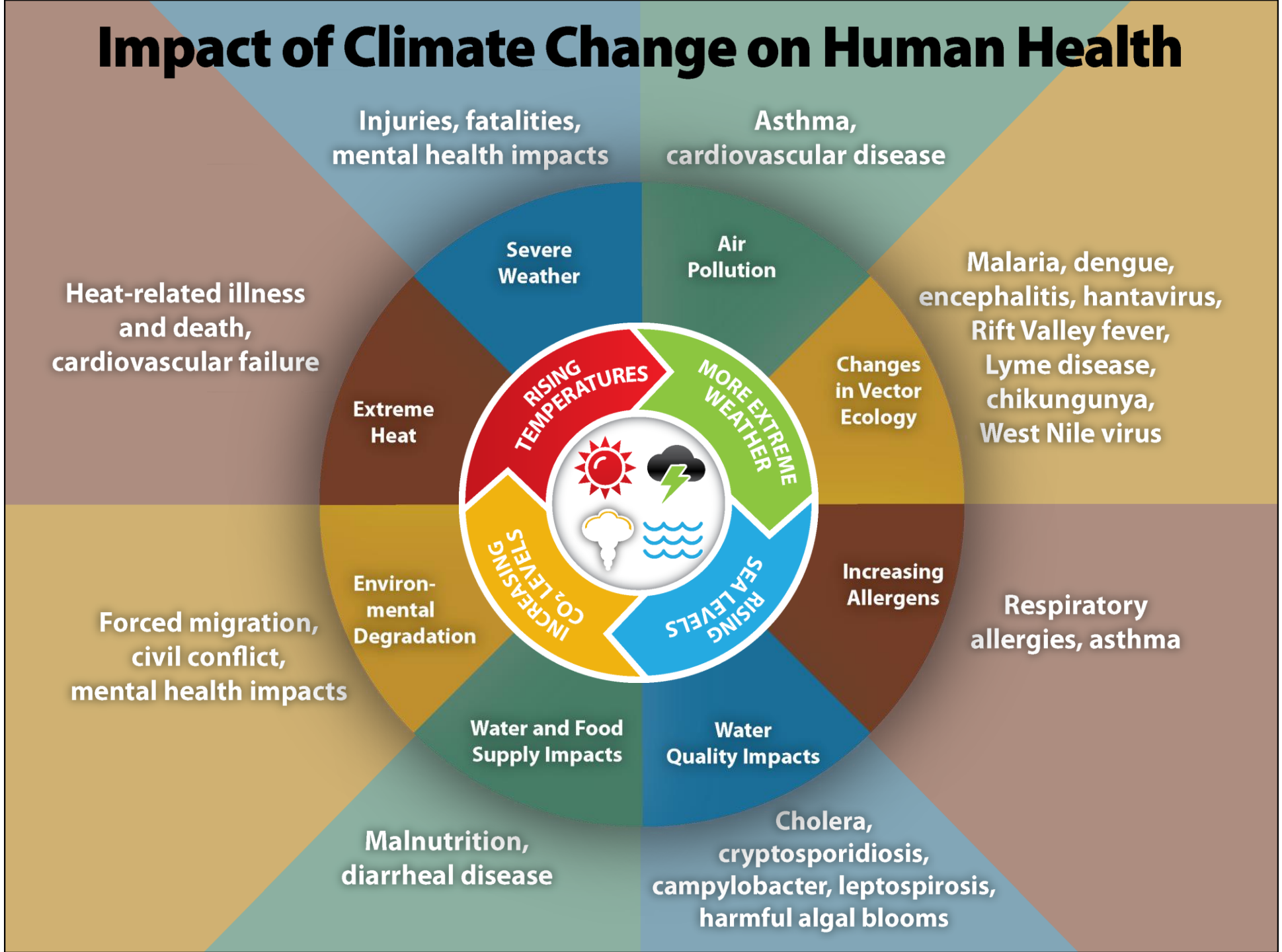
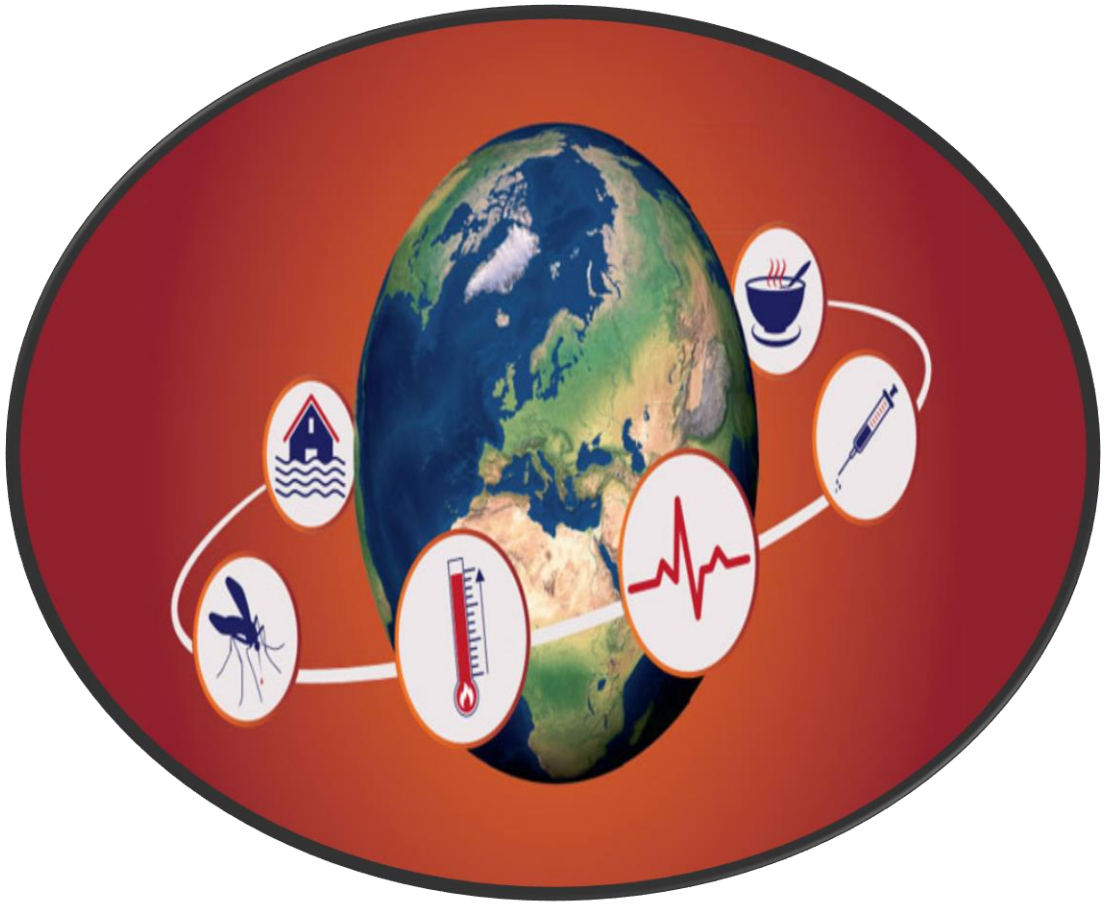
Impact of Climate Change on Human Health





Introduction

Air Pollution

Severe Weather

Vector Ecology

Allergens

Water & Food

Environmental

Climate Change Importance

- Global climate is changing.
- Nowadays, climate change has been recognized as one of the most important challenges in the world.
- These changes are expected to continue in the future Climate change is one of the main global health threats in the 21st century.
- In addition, natural disasters are becoming more frequent and severe due to climate change threatening lives, societies and livelihoods.
- Addressing climate change is important due to its devastating and across-the-board effects, as well as its adverse effects on the environment, economy, and health.

Ref:

- Ford JD. Indigenous health and climate change. American journal of public health. 2012 Jul;102(7):1260-6.
- Costello A, Abbas M, Allen A, Ball S, Bell S, Bellamy R, Friel S, Groce N, Johnson A, Kett M, Lee M. Managing the health effects of climate change: lancet and University College London Institute for Global Health Commission. The Lancet. 2009 May 16;373(9676):1693-733.4

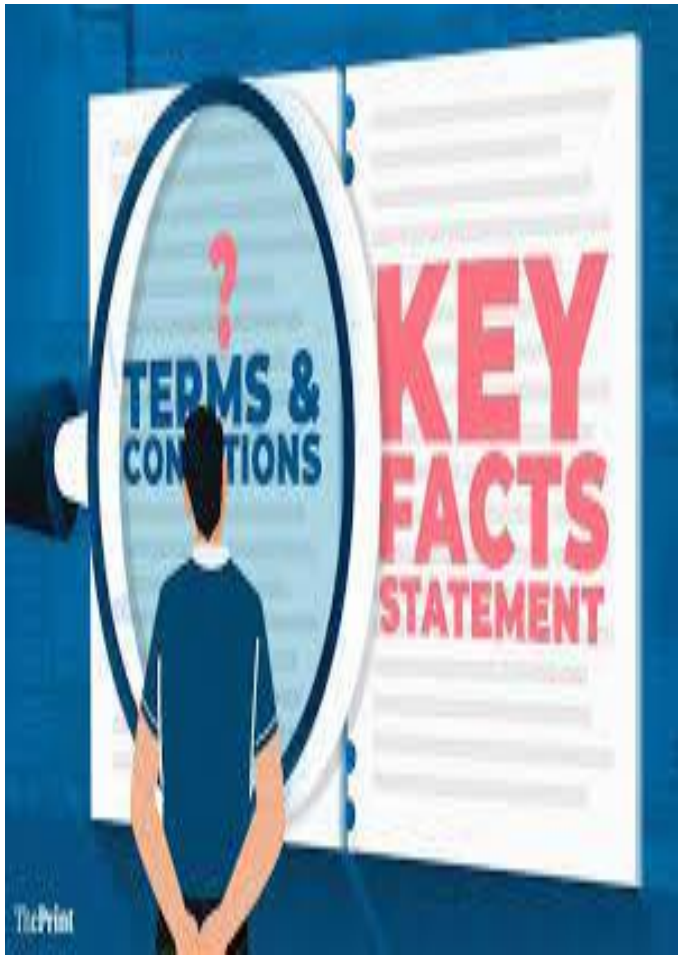
Climate Change Importance

- Nowadays, climate change has been recognized as one of the most important challenges of the world.
- Climate change is also inevitable in Iran.
- The climate of the Middle East, especially Iran, is also changing. Iran is expected to face a 2.6 ° C increase in average temperature and a 35% decrease in precipitation in the coming decades

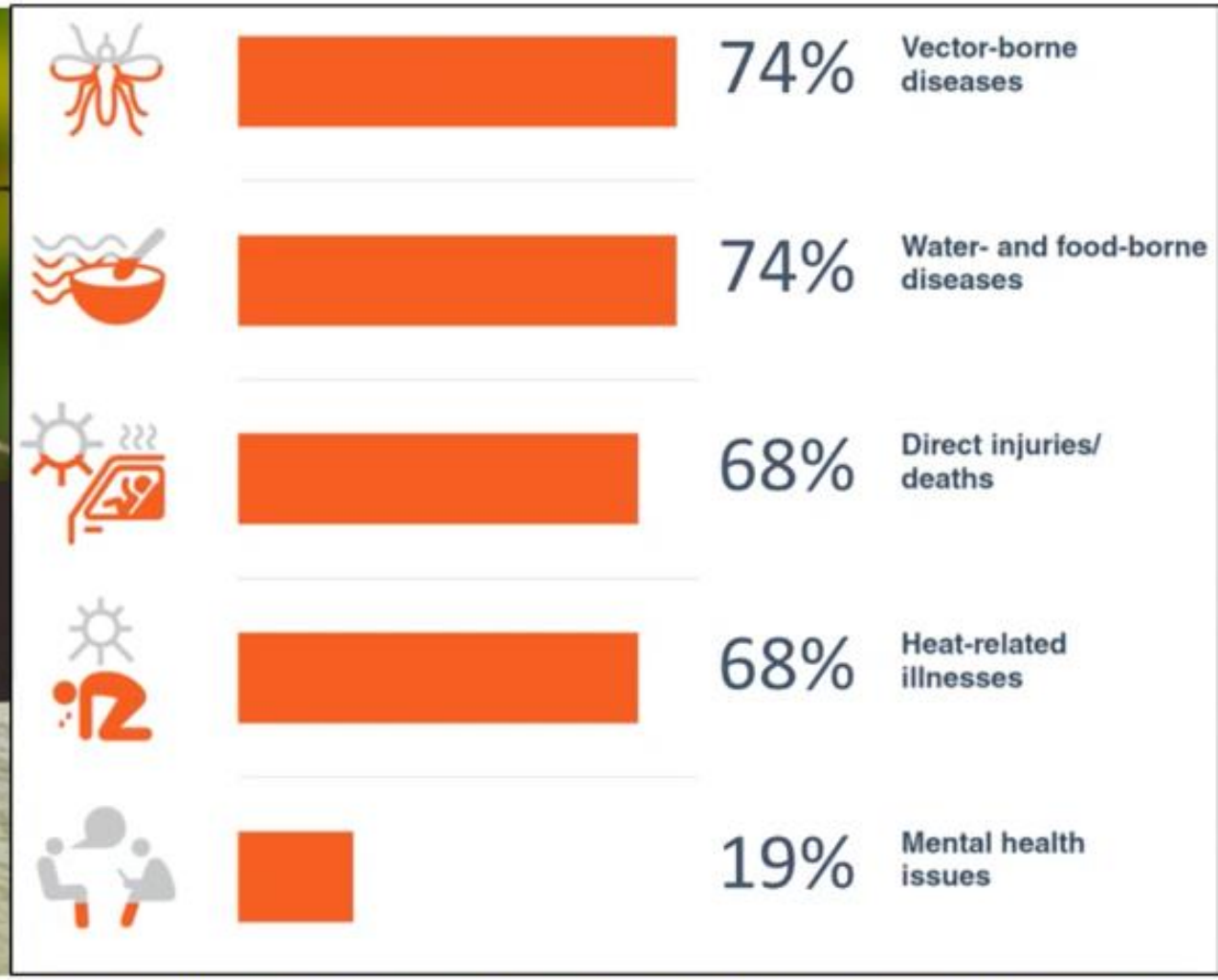
Ref:

- Ford JD. Indigenous health and climate change. American journal of public health. 2012 Jul;102(7):1260-6.
- Costello A, Abbas M, Allen A, Ball S, Bell S, Bellamy R, Friel S, Groce N, Johnson A, Kett M, Lee M. Managing the health effects of climate change: lancet and University College London Institute for Global Health Commission. The Lancet. 2009 May 16;373(9676):1693-733.4
- 3- Daneshvar MR, Ebrahimi M, Nejadsoleymani H. An overview of climate change in Iran: facts and statistics. Environmental Systems Research. 2019 Dec 1;8(1):7.

- Climate change affects the social and environmental determinants of health – clean air, safe drinking water, sufficient food and secure shelter.
- Between 2030 and 2050, climate change is expected to cause approximately 250 000 additional deaths per year, from malnutrition, malaria, diarrhea and heat stress.
- The direct damage costs to health (i.e. excluding costs in health-determining sectors such as agriculture and water and sanitation), is estimated to be between USD 2-4 billion/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 improved health, particularly through reduced air pollution.



Climate change undermines the determinants of health, increasing disease and deaths



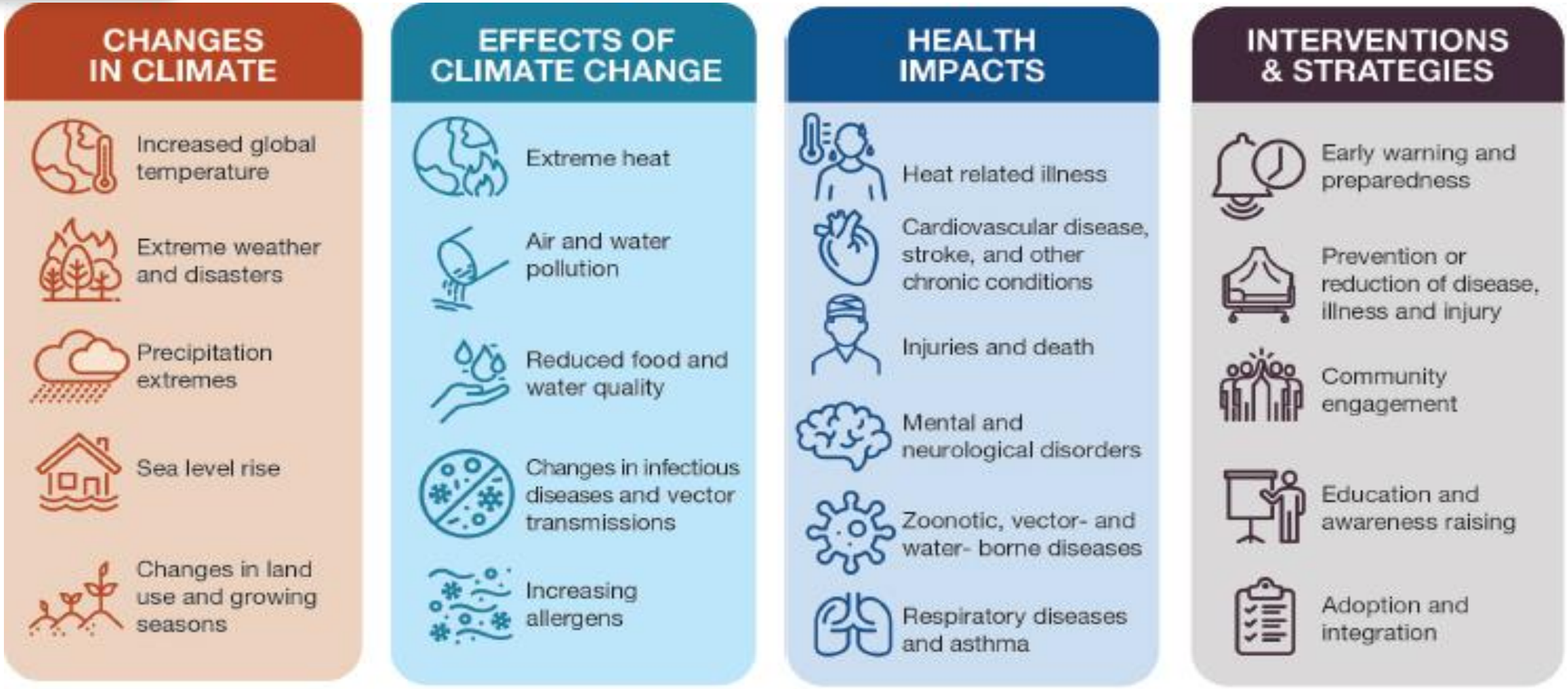
Countries Identifying different health issues in National Health Vulnerability and Adaptation Assessments. 31 V&As reviewed. WHO Climate and Health Survey Report: Tracking Global Progress (2019)

Climate Change and Health

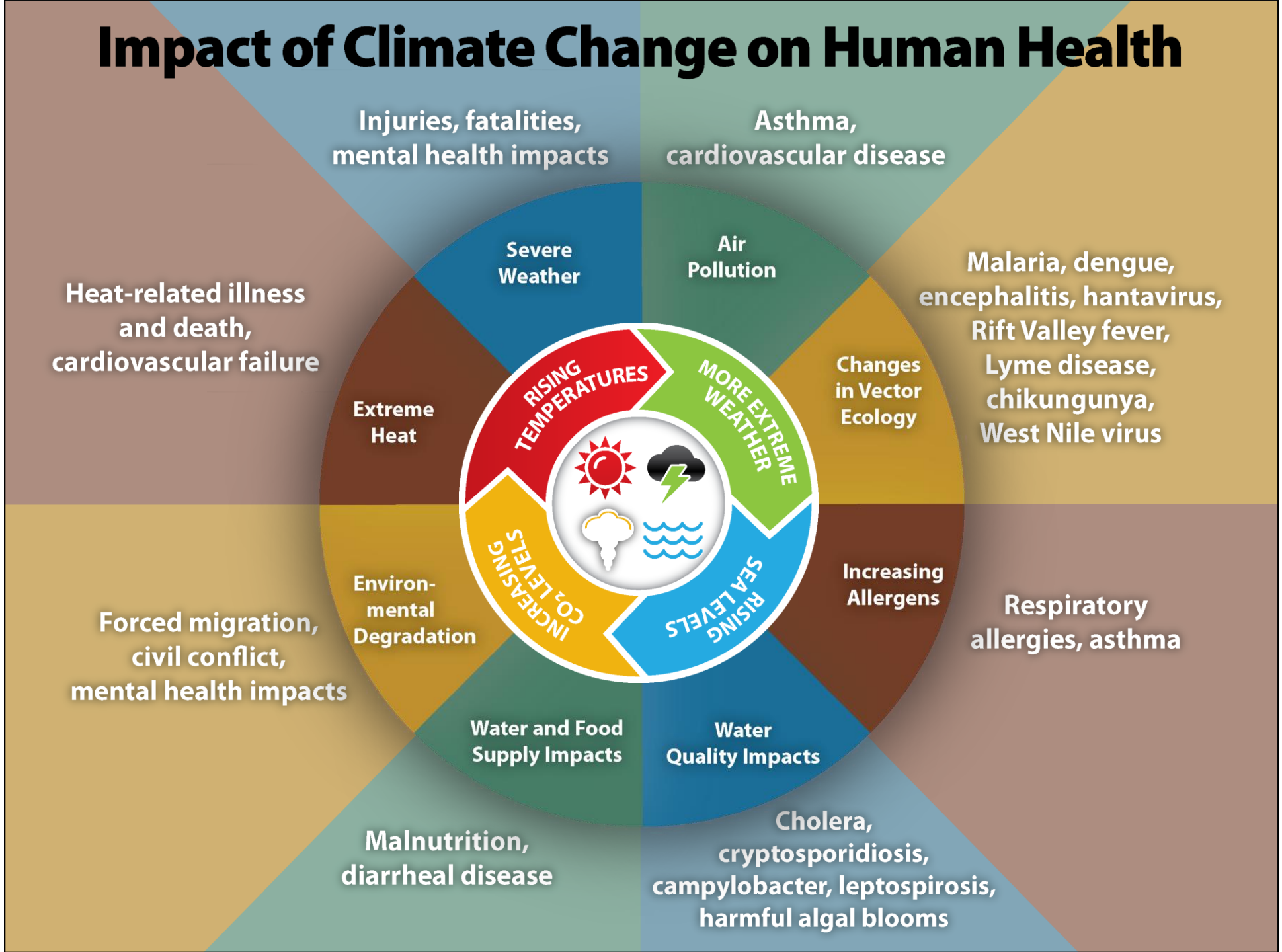
- Climate change affects human health drastically.
- Also, Climate change affects health system.
- Primary Health Care centers and health professionals have vital roles in responding to the health consequences of climate change.
- Investigating sustainability of Primary Health systems has been widely noticed because of the remarkable impacts of climate change consequences.
- Thus, making the right decisions in encountering climate change will undoubtedly reduce its impacts on human health and control the consequences.

Ref:

- WHO W. UNEP. Climate change and human health: risk and responses. Geneva: WHO. 2003.

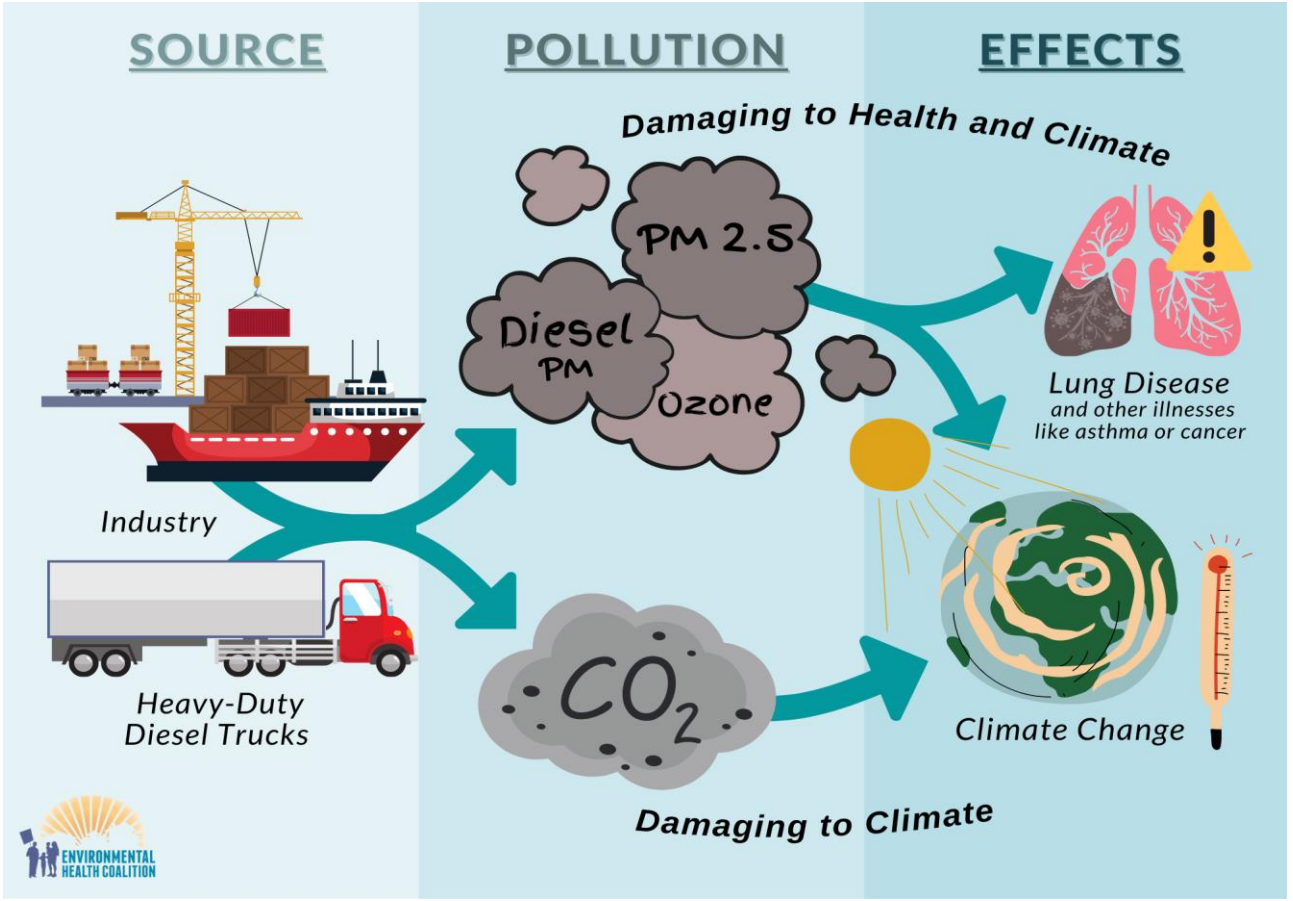

CHANGES IN CLIMATE
Increased global temperature
Extreme weather and disasters
Precipitation extremes
Sea level rise
Changes in land use and growing seasons
EFFECTS OF CLIMATE CHANGE
Extreme heat
Air and water pollution
Reduced food and water quality
Changes in infectious diseases and vector transmissions
Increasing allergens
HEALTH IMPACTS
Heat related illness
Cardiovascular disease, stroke, and other chronic conditions
Injuries and death
Mental and neurological disorders
Zoonotic, vector- and water- borne diseases
Respiratory diseases and asthma
INTERVENTIONS & STRATEGIES
Early warning and preparedness
Prevention or reduction of disease, illness and injury
Community engagement
Education and awareness raising
Adoption and integration

Impact of Climate Change on Human Health



Air Quality

- Climate change affects air quality, which in turn can lead to adverse health outcomes.
- Disruptions to weather patterns influence our air quality by increasing and distributing air pollutants, such as **ground-level ozone, fine particulates, wildfire smoke, and dust**.
- Changes to weather seasons also impact the production, distribution, and severity of airborne allergens.



Extreme Weather

- People around the world are affected by extreme weather events, such as **hurricanes or typhoons, floods, heat waves, wildfires, droughts, and snowstorms.**
- While extreme events have occurred throughout Earth's history, climate change may be increasing their **intensity and occurrence** .
- Extreme weather events threaten human health and well-being.
- They can also disrupt the physical and social infrastructure people and communities rely on to stay safe and healthy before, during, and after a weather-related disaster.
- The immediate effects on human health during extreme weather events can include exposure to the elements, mental health impacts, injury when attempting to escape, and even death caused by the weather event itself, **such as drowning in a flood.**

Change in vector ecology

- Climate is one of the factors that influence the distribution of diseases borne by vectors **(Such as fleas, ticks, and mosquitoes, which spread pathogens that cause illness)**.
- Because warmer average temperatures can mean longer warm seasons, earlier spring seasons, shorter and milder winters, and hotter summers, conditions might become more hospitable for many carriers of vector-borne diseases.
- The geographic and seasonal distribution of vector populations, and the diseases they can carry, depends not only on climate but also on land use, socioeconomic and cultural factors, pest control, access to health care, and human responses to disease risk, among other factors.
- Daily, seasonal, or year-to-year climate variability can sometimes result in vector/pathogen adaptation and shifts or expansions in their geographic ranges. Such shifts can alter disease incidence depending on vector-host interaction, host immunity, and pathogen evolution.

Change in vector ecology

- Vectors and vector-borne diseases are found throughout the world.
- Globally, hundreds of millions of cases and over 700,000 deaths occur from vector-borne diseases annually .
- The most well-known diseases include dengue, malaria, chikungunya, yellow fever, and Zika from mosquitoes; Lyme disease from ticks; plague from fleas; and schistosomiasis from aquatic snails.
- Symptoms from these diseases can vary and include headache, pain, fatigue, dengue hemorrhagic fever (DHF), encephalitis, and nausea.
- The impact on health effects from vector-borne diseases, including their extent and frequency, will vary as the climate changes

Increasing allergens

- climate change will potentially lead to both higher pollen concentrations and longer pollen seasons, causing more people to suffer more health effects from pollen and other allergens.
- Pollen is an airborne allergen that can affect our health.
- Pollen grains are tiny “seeds” dispersed from flowering plants, trees, grass, and weeds
- .The amount and type of pollen in the air depends on the season and geographic region.
- Though pollen counts are typically higher during the warmer seasons, some plants pollinate year-round.

Increasing allergens

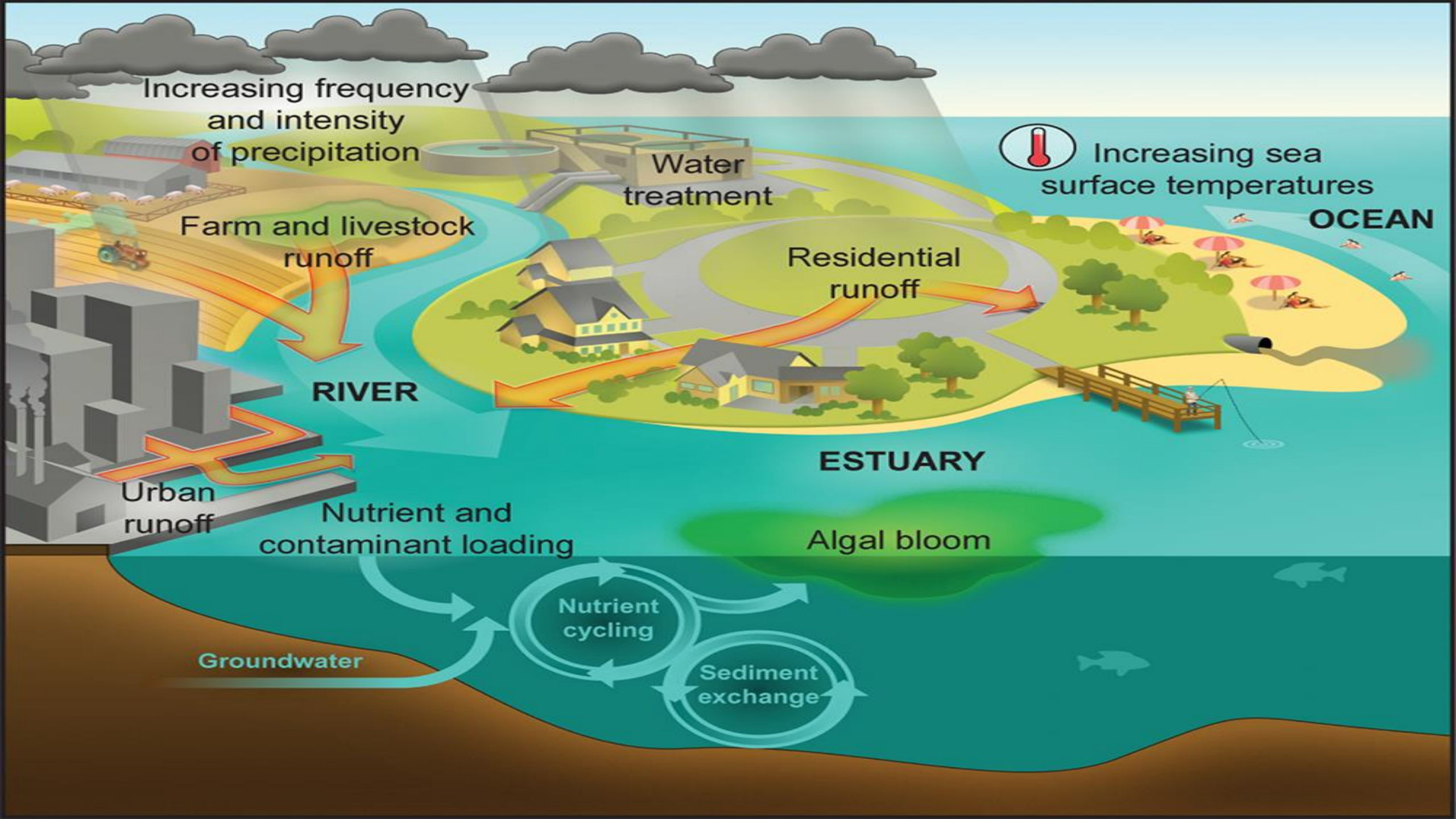
- Climate change will potentially lead to shifts in precipitation patterns, more frost-free days, warmer seasonal air temperatures, and more carbon dioxide (CO_2) in the atmosphere. These changes can affect:
- when the pollen season starts and ends and how long it lasts each year,
- how much pollen plants create and how much is in the air,
- how pollen affects our health (the “allergenicity” of pollen),
- how much pollen we’re exposed to, and
- our risk of experiencing allergy symptoms.
- Pollen exposure can trigger various allergic reactions, including symptoms of hay fever. Hay fever, also known as allergic rhinitis, occurs when allergens like pollen enter your body and your immune system mistakenly identifies them as a threat.

Climate Change and Water Quality

- Climate change is expected to increase the incidence of water-related illnesses by disrupting marine and freshwater resources .
- Rising sea surface temperature, changes in frequency and intensity of precipitation, as well as agricultural and industrial runoff from more frequent storms, can create conditions for pathogens to thrive and contaminate bodies of water.
- These contaminants include bacteria, viruses, protozoa, and toxins, and exposure to them through ingestion, inhalation, or direct contact can cause water-related illness such as vibriosis.

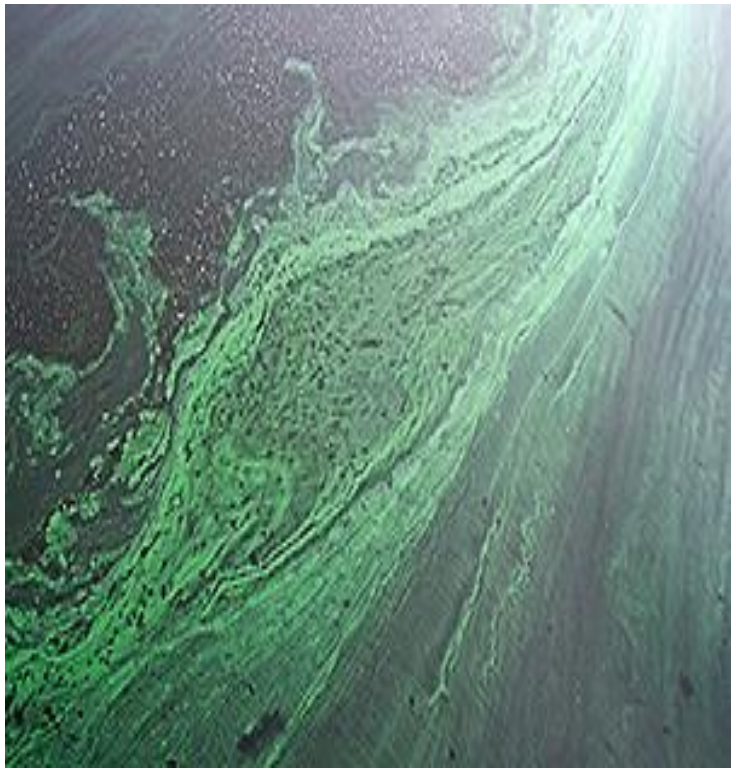
Water quality impact

- Exposure to contaminated water can lead to adverse health effects from waterborne illnesses.
- Swimming or fishing in polluted water sources and consumption of affected seafood are the most common pathways of exposure.
- Some common water-related illnesses are diarrhea, giardiasis, dysentery, typhoid fever, *E. Coli* infection, and salmonellosis.
- Adverse health effects can include pain in the gastrointestinal, reproductive, neurological systems, and other symptoms. Continuous exposure can have long-lasting health impacts.


Increasing frequency and intensity of precipitation
Water treatment
Increasing sea surface temperatures
OCEAN
Farm and livestock runoff
Residential runoff
RIVER
ESTUARY
Urban runoff
Nutrient and contaminant loading
Algal bloom
Nutrient cycling
Sediment exchange
Groundwater

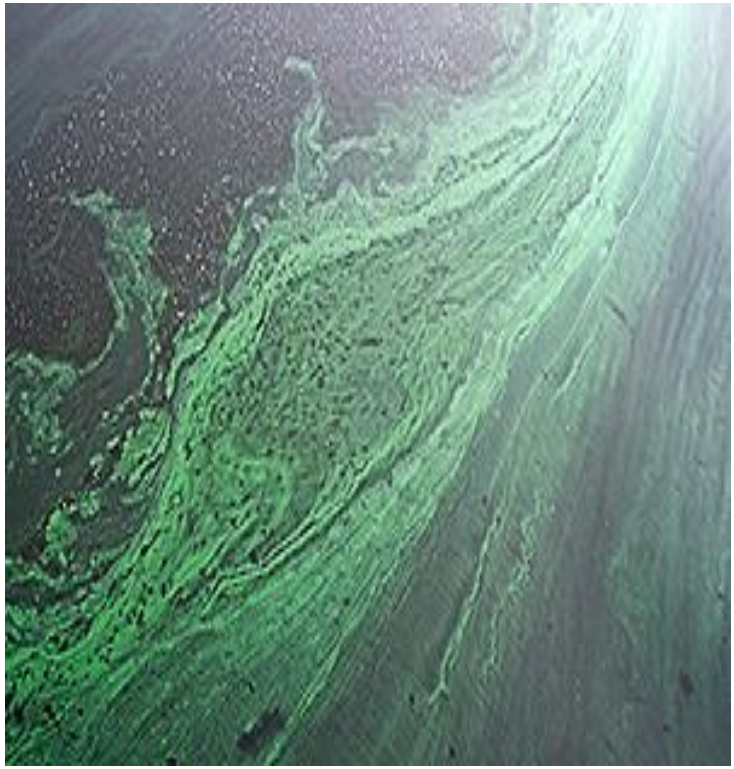
Water and Food Supply Impact: Diarrheal Disease

- Diarrheal disease is a major public health issue in developing countries and remains a persistent concern.
- Exposure to a variety of pathogens in water and food causes diarrheal disease.
- Air and water temperatures, precipitation patterns, extreme rainfall events, and seasonal variations are all known to affect disease transmission
- Mostly, children and the elderly are most vulnerable to serious outcomes, and those exposed to inadequately or untreated groundwater will be among those most affected.



Water and Food Supply Impact: Diarrheal Disease

- In general, diarrheal diseases, including salmonellosis and campylobacteriosis, are more common when temperatures are higher, though patterns differ by place and pathogen.
- Diarrheal diseases have also been found to occur more frequently in conjunction with both unusually high and low precipitation.
- Sporadic increases in stream flow rates, often preceded by rapid snowmelt and changes in water treatment, have also been shown to precede outbreaks.
- Risks of waterborne illness and beach closures resulting from changes in the magnitude of recent precipitation (within the previous 24 hours) and in lake temperature are expected to increase in the Great Lakes region as a result of climate change.



Water and Food Supply Impact: Food system

- Climate change is impacting our global food system in a variety of direct and indirect ways and presenting new challenges to food safety and human health.
- Changes in temperature and precipitation can affect the distribution and survivability of pathogens that cause foodborne illnesses .
- Changes in climate can cause severe droughts or flooding.
- These events can in turn affect pathogens and introduce toxins to crops.
- Ingestion of food contaminated with pathogens can result in foodborne illnesses, such as norovirus infection or salmonellosis.

Water and Food Supply Impact: Food Quality

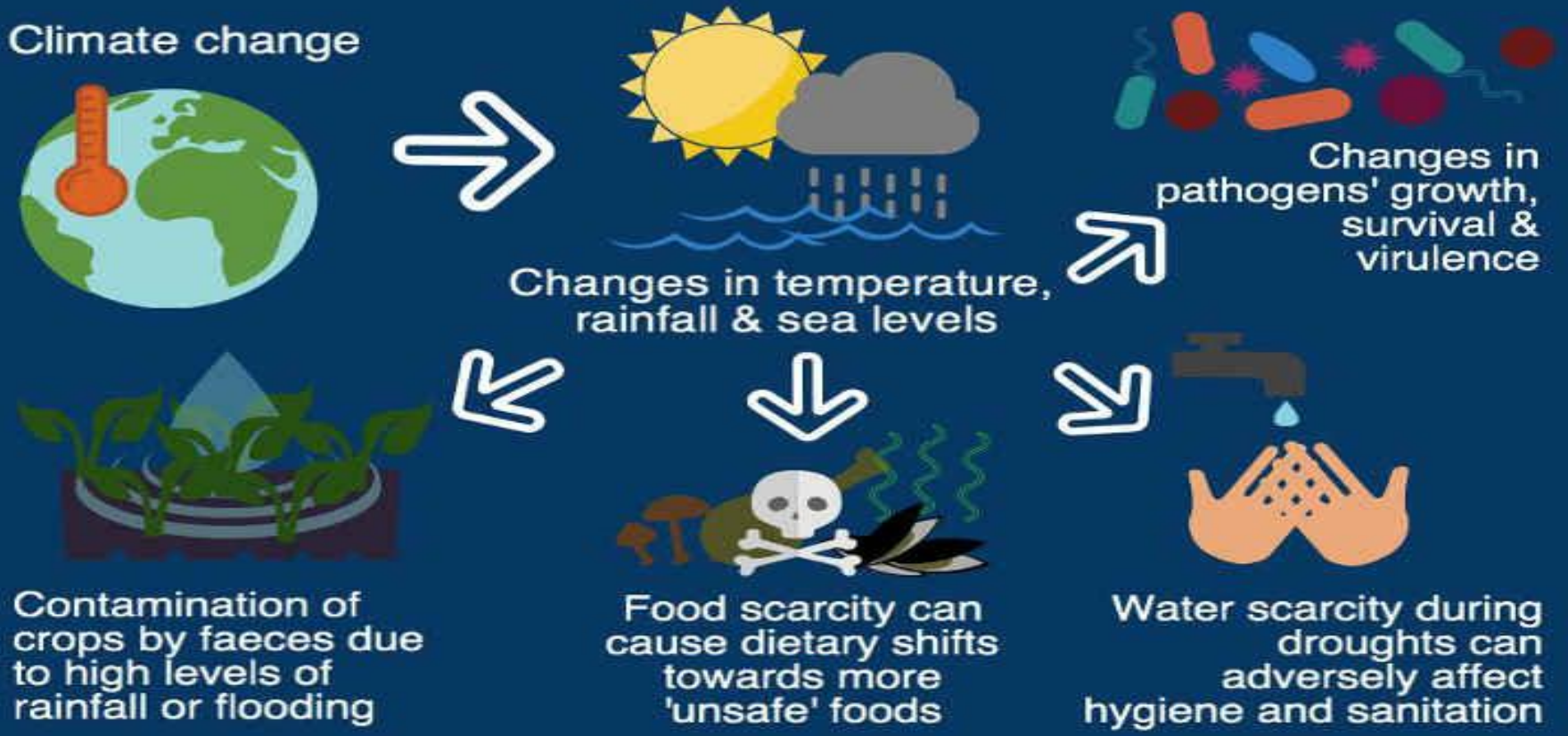
- Climate change is also projected to affect the quality of food.
- The increase in atmospheric carbon dioxide associated with climate change can affect the nutritional value of staple crops and exacerbate malnutrition by reducing protein content and essential minerals

Water and Food Supply Impact: Food Safety and malnutrition

- Food safety refers to the conditions and processes throughout the food system that ensure food is safe for human consumption.
- Globally, about one in 10 people become ill with a foodborne illness, and over 420,000 deaths occur every year .
- Changes in air and water temperatures can modify the seasonal and geographic occurrence of bacteria, viruses, parasites, fungi, and pests as well as chemical contaminants.
- Higher temperatures can increase the number of pathogens already present on produce and seafood, while bacterial populations can increase during food storage which, depending on time and temperature, can also raise food spoilage rates
- Droughts and flooding exacerbated by climate change can impact the staple crops that these populations subsist on.
- The impacts of climate change on food systems can affect everyone, but some groups are more vulnerable. **Women, children, older adults, low-income populations, Indigenous Peoples, and small-scale food producers** more often experience malnutrition

How Does Climate Change Affect Food Safety?

Climate change can increase food- and water-borne disease risks in many ways. Many pathogens, such as those responsible for cholera, are sensitive to changing temperatures, rainfall and extreme weather. This diagram summarises some of the main mechanisms:



THE GLOBAL CLIMATE & HEALTH ALLIANCE

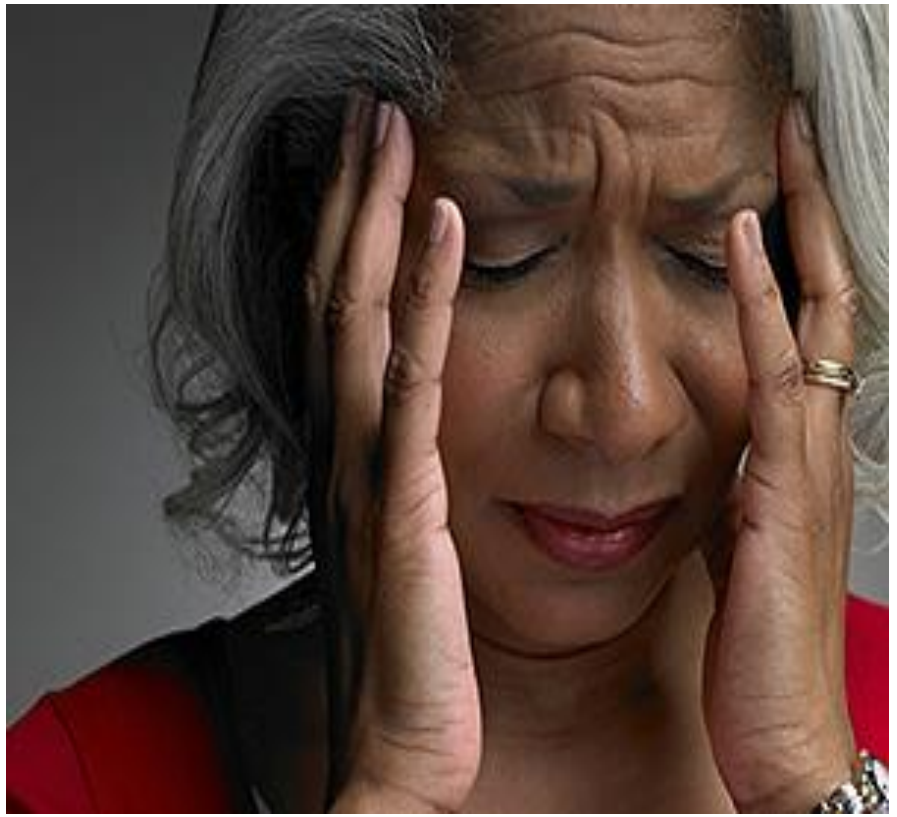
References

WHO, 2014: Food safety. Fact sheet N. 399 http://www.who.int/mediacentre/factsheets/fs399/en/

Smith, K.R., et al, 2014: Human health: impacts, adaptation, and co-benefits. In: Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part A: Global and Sectoral Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, pp. 709-754.

Environmental degradation: Mental Health and Stress-Related Disorders

- Mental illness is one of the major causes of suffering in the world, and extreme weather events can affect mental health in several ways.
- Following disasters, mental health problems increase, both among people with no history of mental illness, and those at risk – a phenomenon known as **"common reactions to abnormal events."**

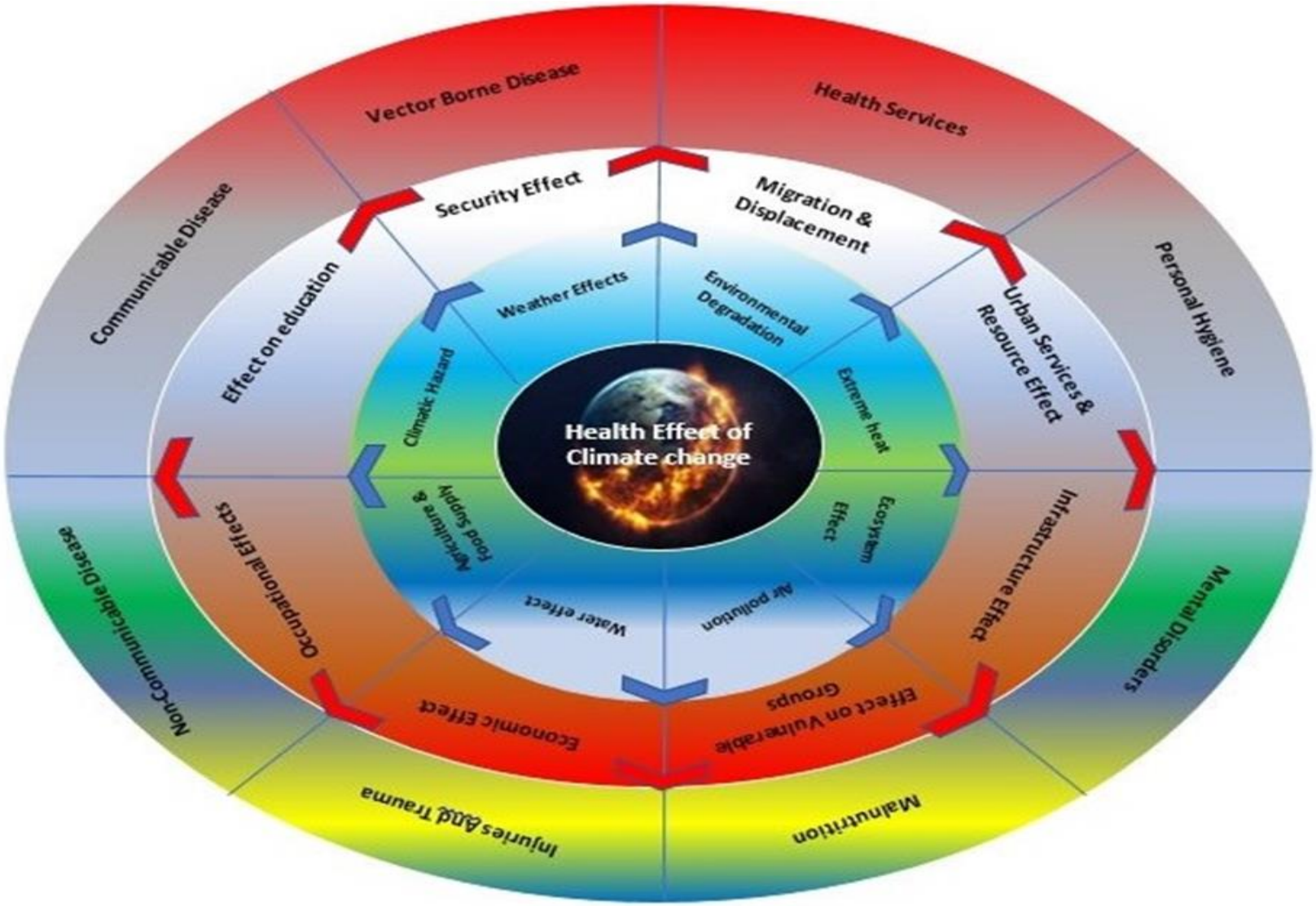


Environmental degradation: Mental Health and Stress-Related Disorders

- These reactions may be short-lived or, in some cases, long-lasting.
- For example, research demonstrated high levels of anxiety and post-traumatic stress disorder among people affected by Hurricane Katrina, and similar observations have followed floods and heat waves.
- Some evidence suggests wildfires have similar effects.
- All of these events are increasingly fueled by climate change.
- Other health consequences of intensely stressful exposures are also a concern, including pre-term birth, low birth weight, and maternal complications.

Environmental degradation: Mental Health and Stress-Related Disorders

- In addition, some patients with mental illness are especially susceptible to heat.
- Suicide rates vary with weather, rising with high temperatures, suggesting potential impacts from climate change on depression and other mental illnesses.
- Dementia is a risk factor for hospitalization and death during heat waves.
- Patients with severe mental illness, such as schizophrenia, are at risk during hot weather because their medications may interfere with temperature regulation or even directly cause hyperthermia.
- Additional potential mental health impacts, less well understood, include the possible distress associated with environmental degradation and displacement and the anxiety and despair that knowledge of climate change might elicit in some people.



- **Exploring Medical Students' Perceptions and Understanding of the Health Impacts of Climate Change: A Qualitative Content Analysis**


COMMUNITIES OF COLOR
Some communities of color living in risk-prone areas face cumulative exposure to multiple pollutants.
Adaptation plans that consider these communities and improve access to healthcare help address social inequities.
OLDER ADULTS
Older adults are vulnerable to extreme events that cause power outages or require evacuation.
Checking on elderly neighbors and proper emergency communication can save lives.
CHILDREN
Children have higher risk of heat stroke and illness than adults.
Adults can lessen risk by monitoring exertion and hydration.
LOW INCOME COMMUNITIES
Low income families are at risk of physical and mental illnesses during flooding and in crowded shelter conditions.
Comprehensive disaster management can improve resiliency for people with limited resources.

Key Focus Areas

World Health Organization

To advance climate-resilient health, WHO works in three key focus areas:

1

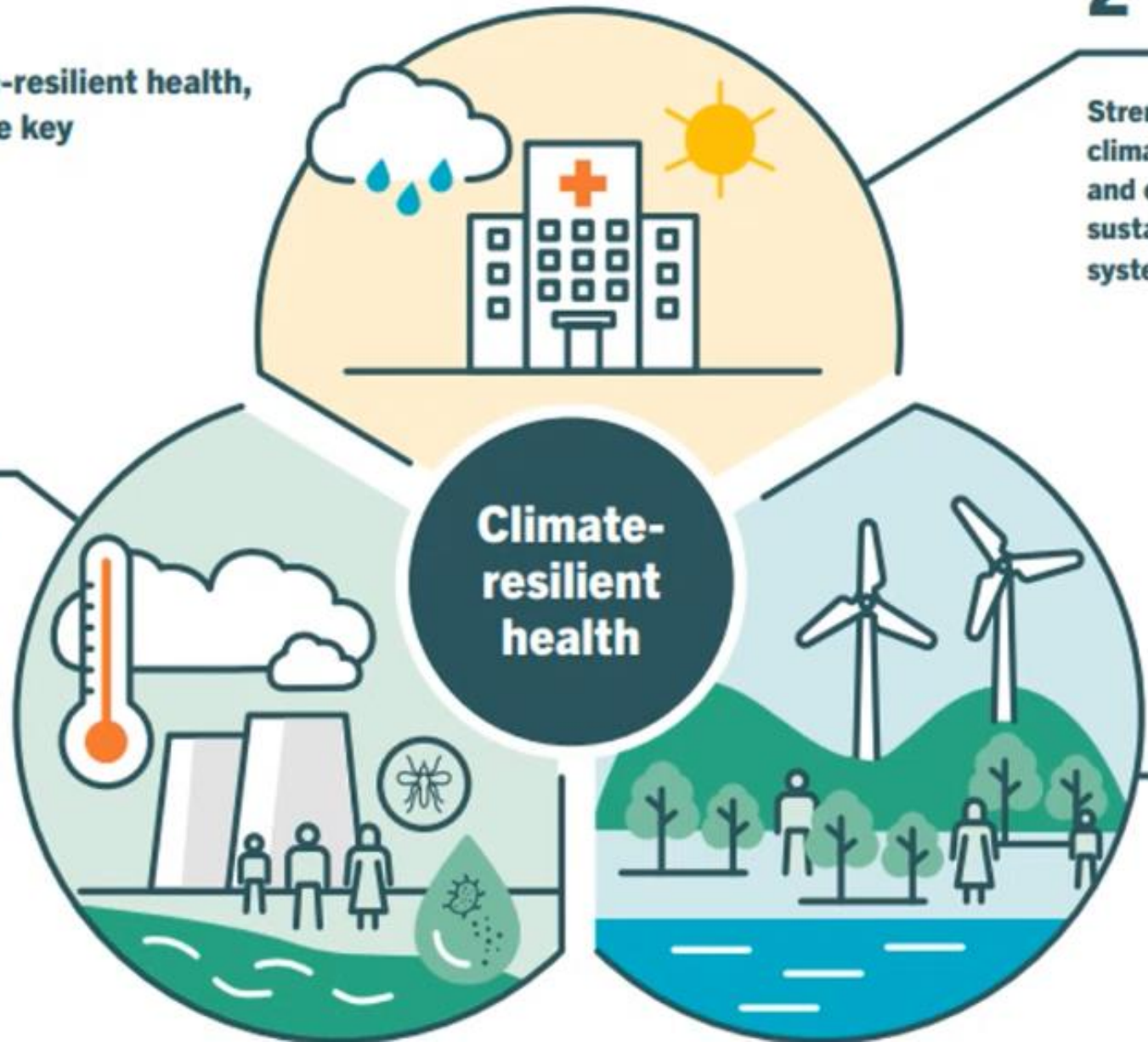
Addressing the wide range of health impacts of climate change

2

Strengthening the climate resilience and environmental sustainability of health systems and facilities

3

Promoting the health co-benefits of climate change mitigation in other sectors



Thank you for your attention

Projection of Climate-related Health

Presenter:

Omid Aboubakri

Assistant Professor of Epidemiology

- Climate change is now widely recognized as the biggest global threat of the 21st century.

- High-end scenarios, in which no mitigation strategies are in place, predict an average increase in surface temperature between 2.6 °C and 4.8 °C by the end of this century (2081–2100) relative to 1986–2005

- Scenarios of climate conditions depend therefore on current and future trajectories of greenhouse gas emissions, mainly determined by socioeconomic development and climate policies.

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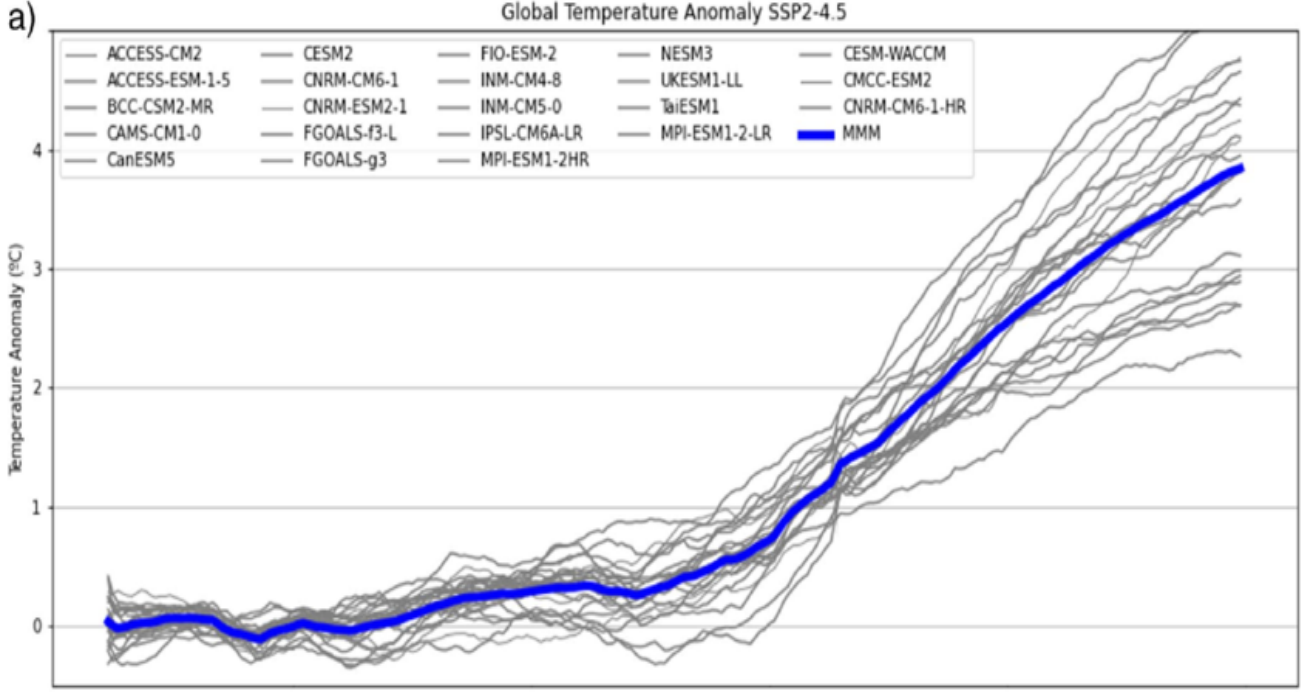
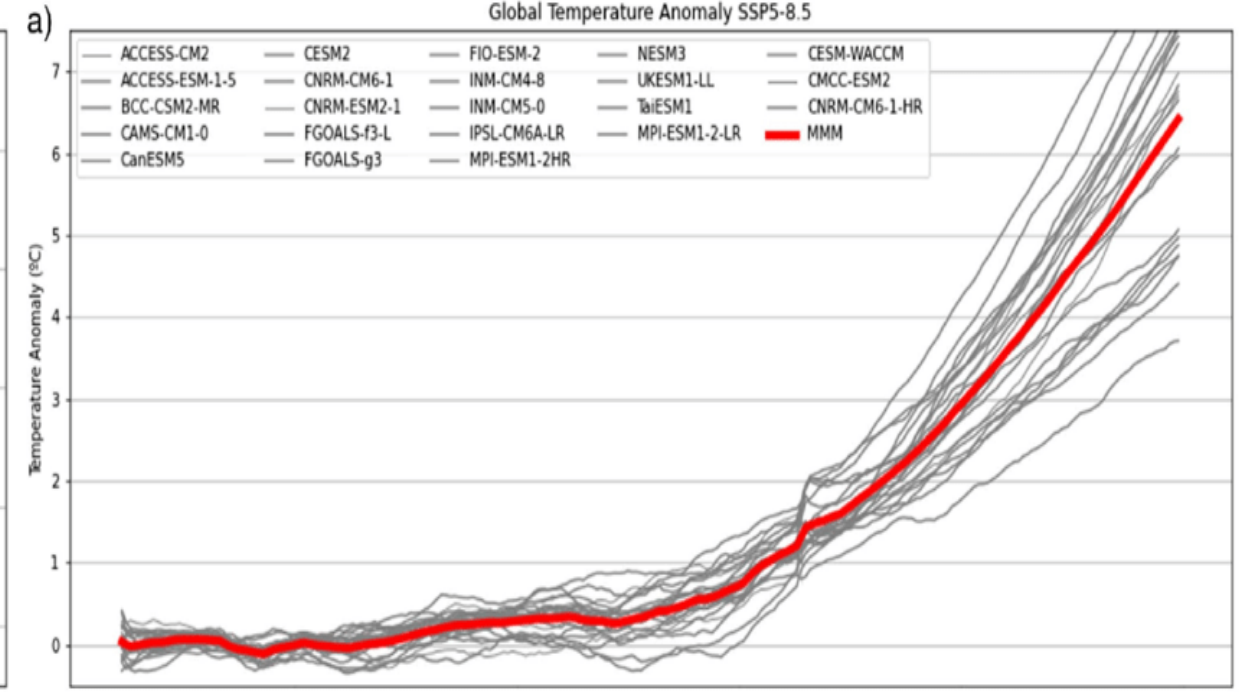
Scenarios :

RCPs
SSPs

GCM Models


a)
Global Temperature Anomaly SSP2-4.5
ACCESS-CM2
ACCESS-ESM-1-5
BCC-CSM2-MR
CAMS-CM1-0
CanESM5
CESM2
CNRM-CM6-1
CNRM-ESM2-1
FGOALS-f3-L
FGOALS-g3
FIO-ESM-2
INM-CM4-8
INM-CM5-0
IPSL-CM6A-LR
MPI-ESM1-2HR
NESM3
UKESM1-LL
TaiESM1
MPI-ESM1-2-LR
CESM-WACCM
CMCC-ESM2
CNRM-CM6-1-HR
MMM
Temperature Anomaly (°C)


a)
Global Temperature Anomaly SSP5-8.5
ACCESS-CM2
ACCESS-ESM-1-5
BCC-CSM2-MR
CAMS-CM1-0
CanESM5
CESM2
CNRM-CM6-1
CNRM-ESM2-1
FGOALS-f3-L
FGOALS-g3
FIO-ESM-2
INM-CM4-8
INM-CM5-0
IPSL-CM6A-LR
MPI-ESM1-2HR
NESM3
UKESM1-LL
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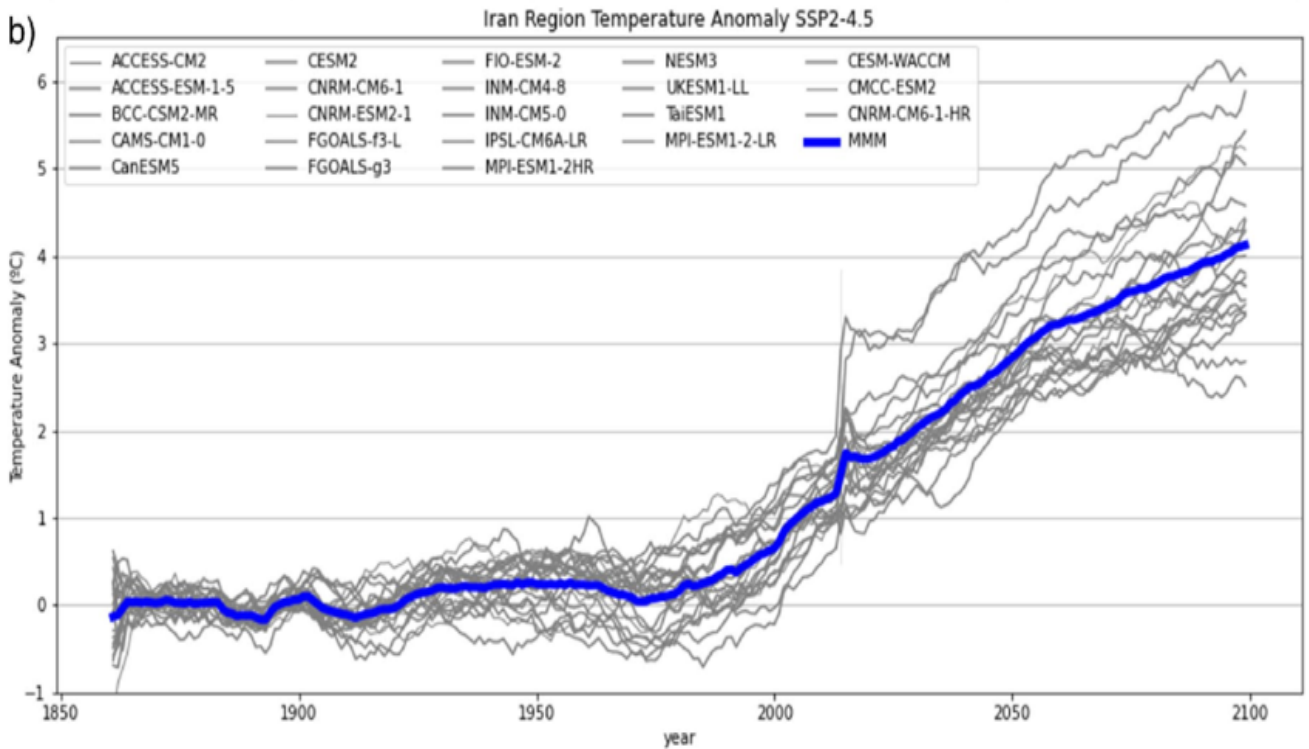
CESM-WACCM
CMCC-ESM2
CNRM-CM6-1-HR
MMM
Temperature Anomaly (°C)


b)
Iran Region Temperature Anomaly SSP2-4.5
ACCESS-CM2
ACCESS-ESM-1-5
BCC-CSM2-MR
CAMS-CM1-0
CanESM5
CESM2
CNRM-CM6-1
CNRM-ESM2-1
FGOALS-f3-L
FGOALS-g3
FIO-ESM-2
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INM-CM5-0
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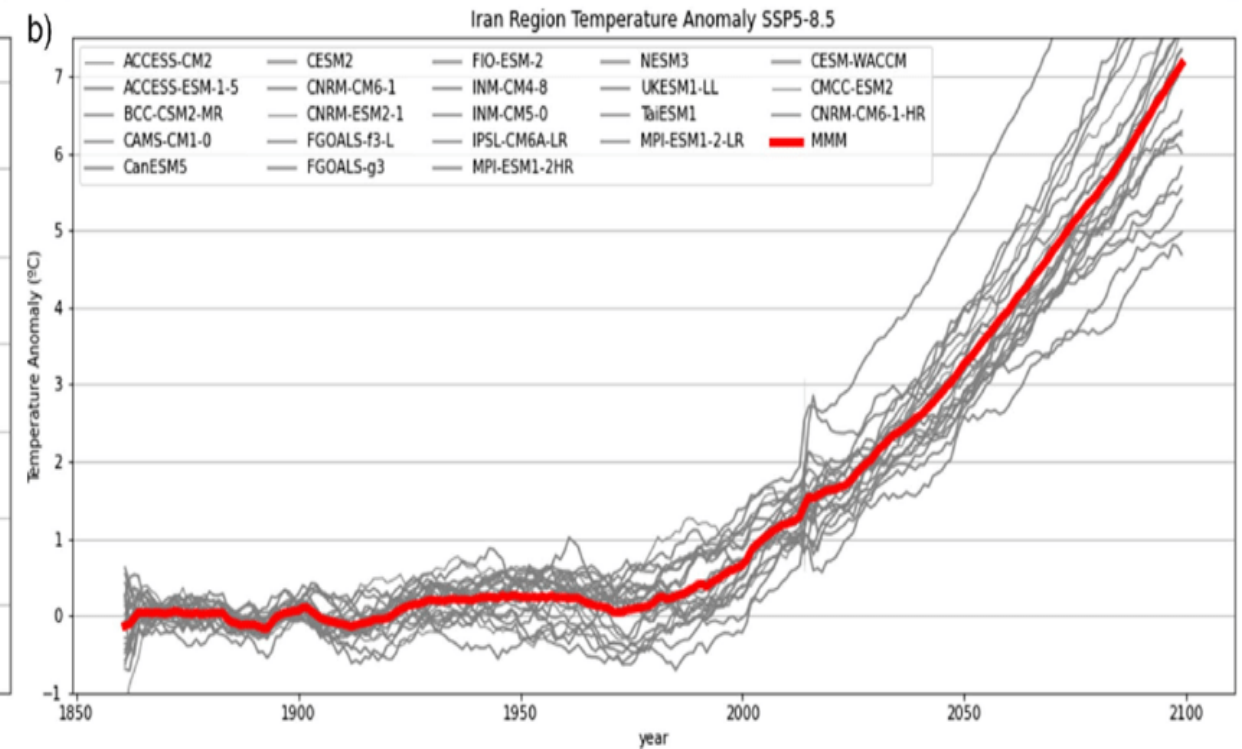
MMM
Temperature Anomaly (°C)
year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Iran Region Temperature Anomaly SSP5-8.5
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ACCESS-ESM-1-5
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CNRM-ESM2-1
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FIO-ESM-2
INM-CM4-8
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IPSL-CM6A-LR
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CESM-WACCM
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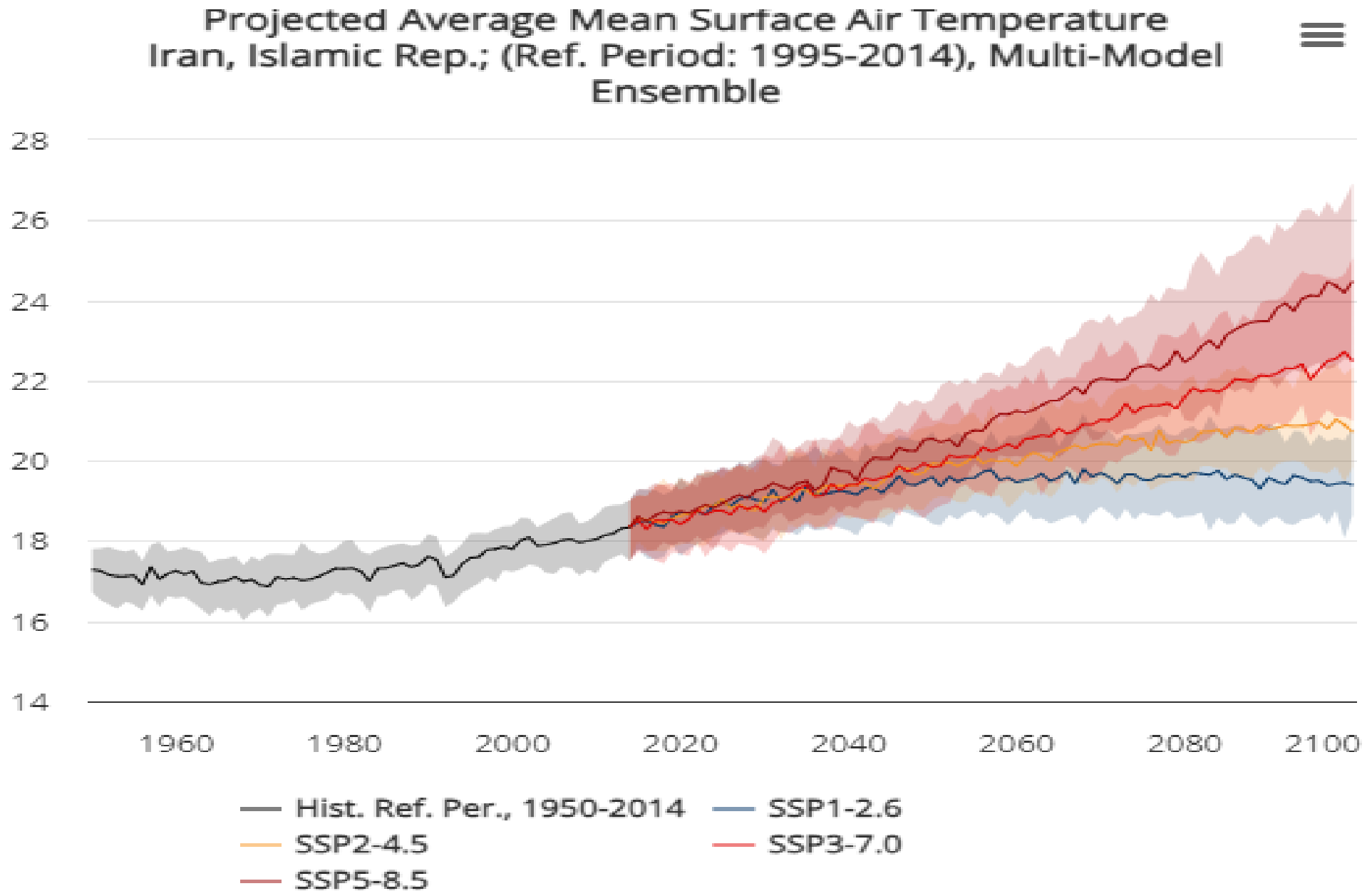
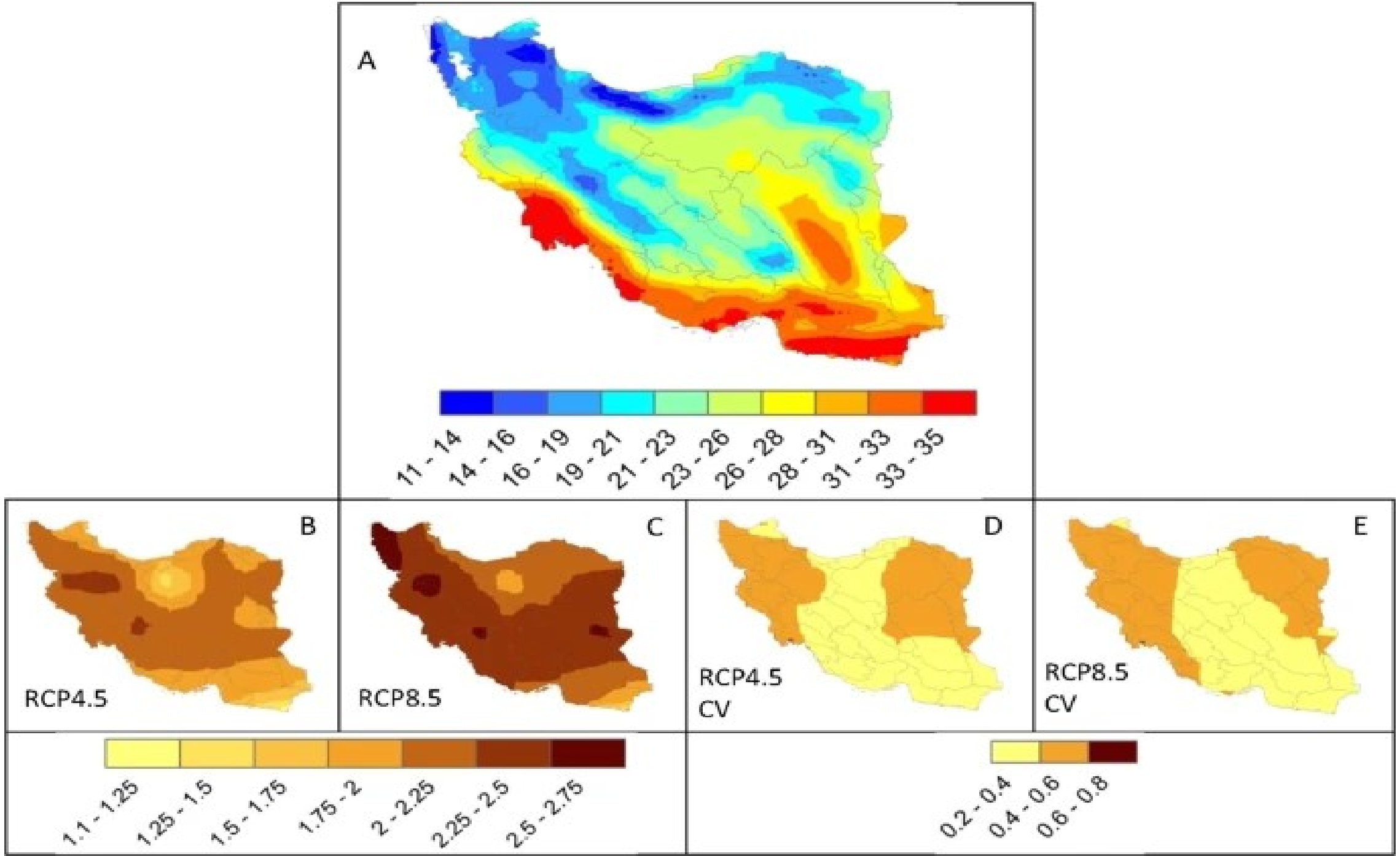
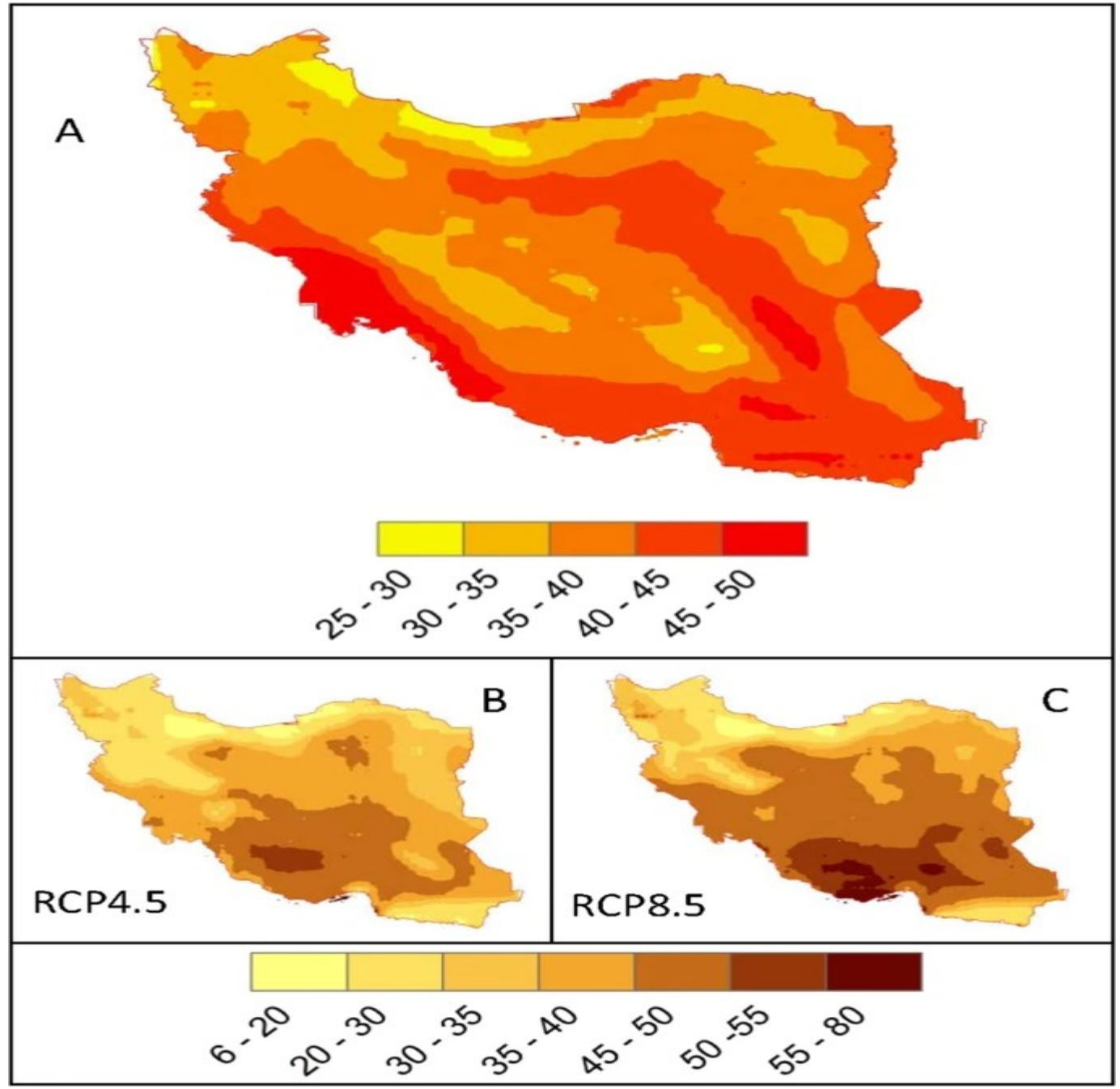
CNRM-CM6-1-HR
MMM
Temperature Anomaly (°C)
year

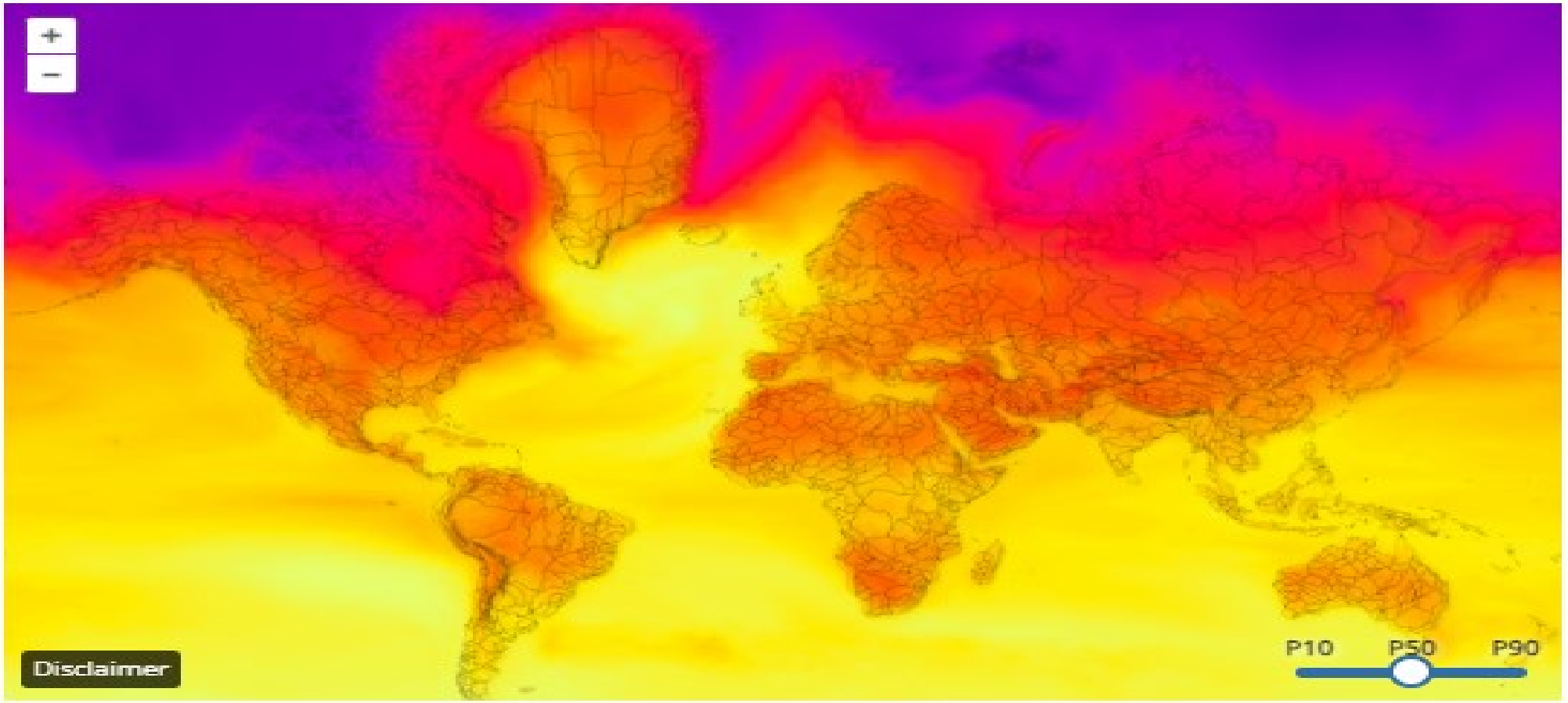
Climate knowledge portal: world bank




A
11 - 14
14 - 16
16 - 19
19 - 21
21 - 23
23 - 26
26 - 28
28 - 31
31 - 33
33 - 35
B
RCP4.5
C
RCP8.5
D
RCP4.5
CV
E
RCP8.5
CV
1.1 - 1.25
1.25 - 1.5
1.5 - 1.75
1.75 - 2
2 - 2.25
2.25 - 2.5
2.5 - 2.75
0.2 - 0.4
0.4 - 0.6
0.6 - 0.8


A
25 - 30
30 - 35
35 - 40
40 - 45
45 - 50
B
RCP4.5
C
RCP8.5
6 - 20
20 - 30
30 - 35
35 - 40
45 - 50
50 - 55
55 - 80

Projected Average Mean Surface Air Temperature Anomaly for 2080-2099 (Annual)
Watershed #339; (Ref. Period: 1995-2014), SSP5-8.5, Multi-Model Ensemble



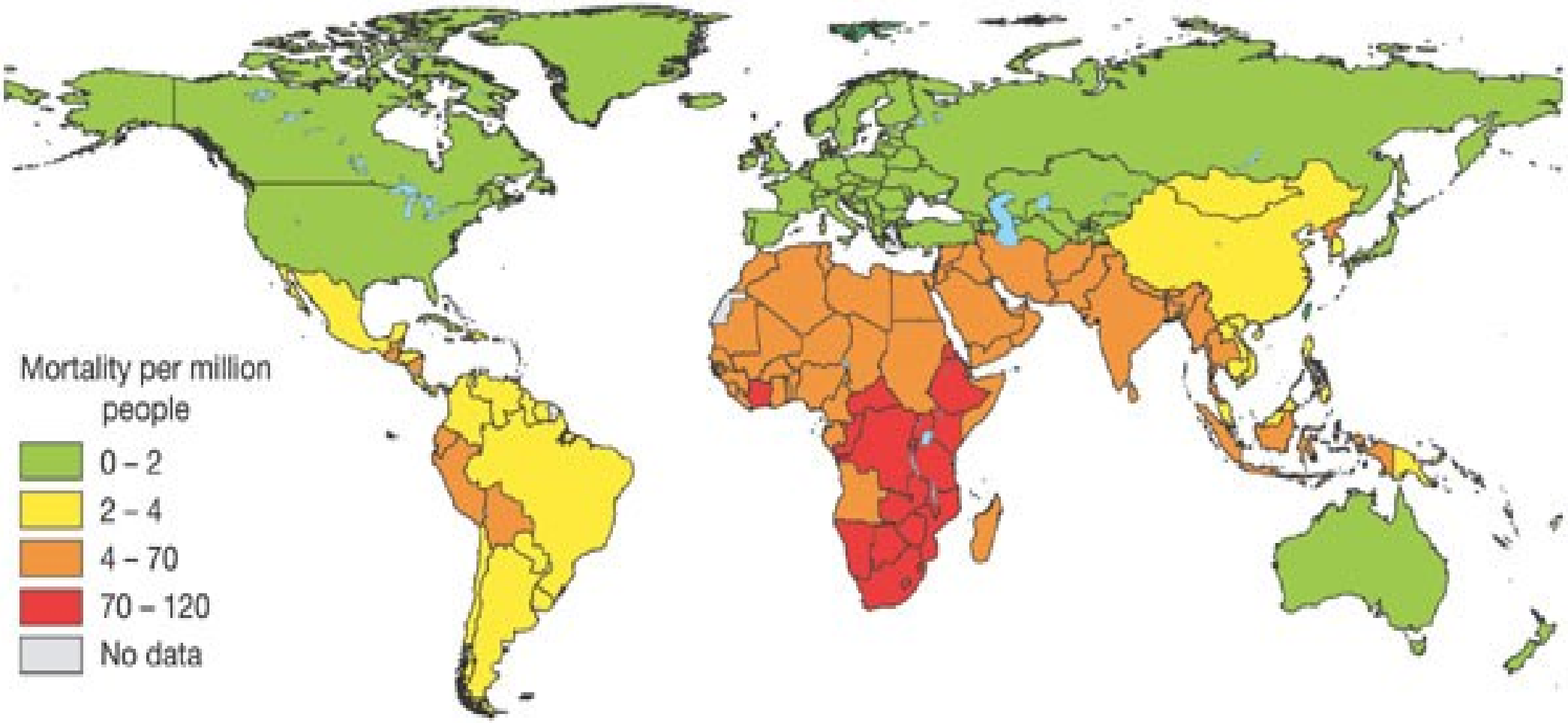
TEMPERATURE (°C)

0 2 4 6 9 11 13 15+

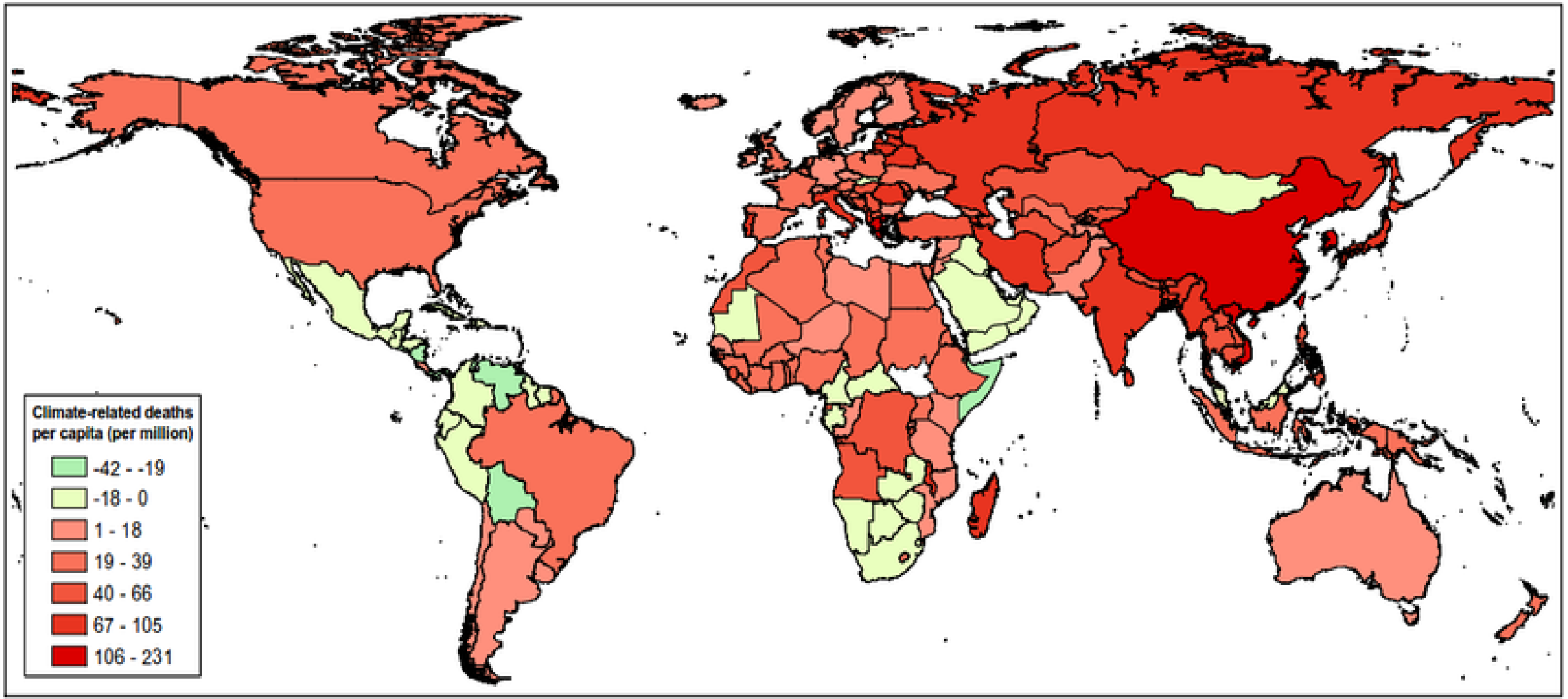
Climate change-related Health

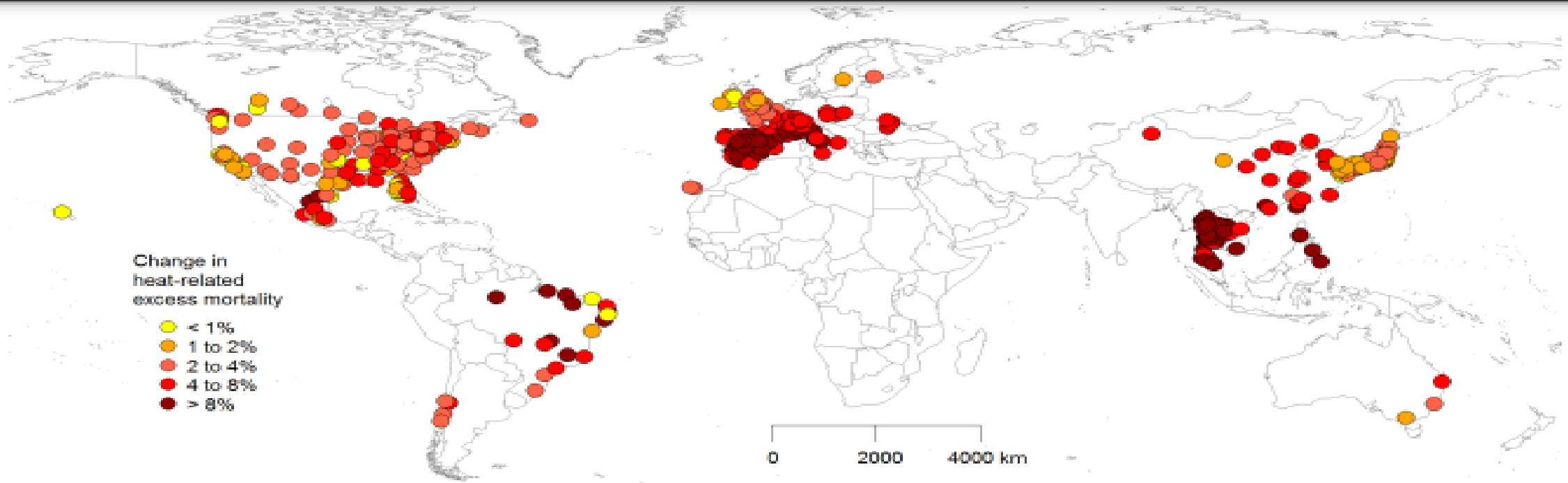
- In addition to indirect effects mediated, for instance, by the spread of disease vectors, increase in food insecurity, and migration and conflicts, direct effects are expected from the increase in extreme weather events such as floods, droughts, and heatwaves.
- Other direct mechanism: diurnal temperature, modifying effect of humidity, climate comforts,…

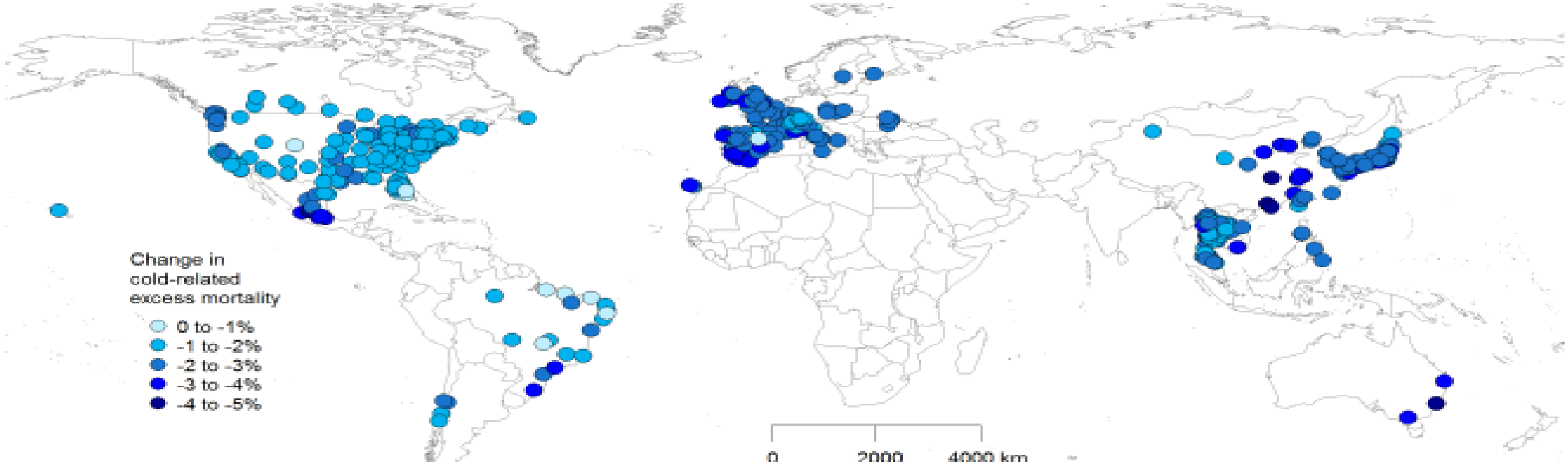
- Lagged effect of cold and heat (harvesting effect)

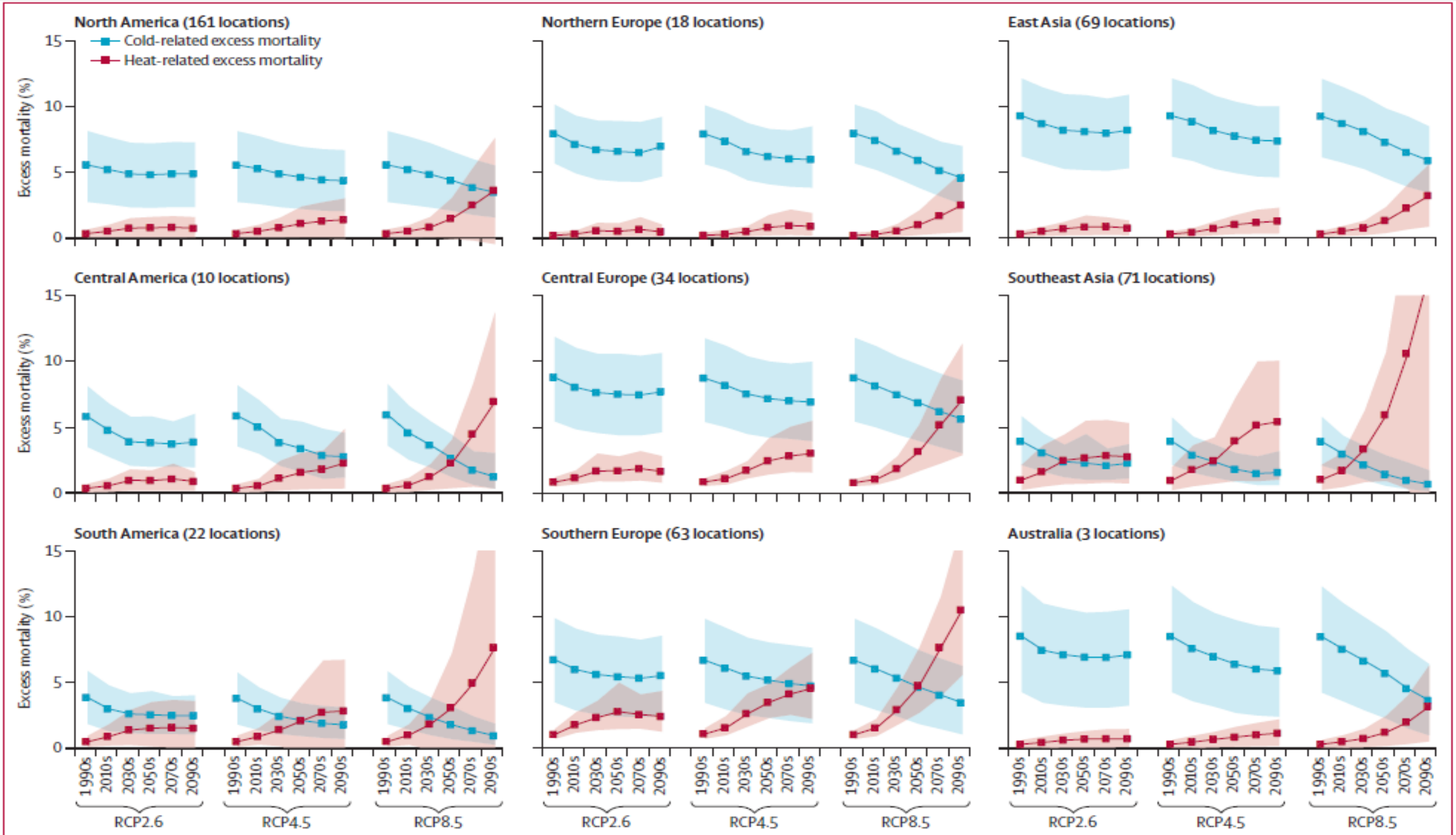

Mortality per million people
0 – 2
2 – 4
4 – 70
70 – 120
No data

An example; The data!




Change in
heat-related
excess mortality
< 1%
1 to 2%
2 to 4%
4 to 8%
> 8%
0
2000
4000 km


Change in
cold-related
excess mortality
0 to -1%
-1 to -2%
-2 to -3%
-3 to -4%
-4 to -5%
0
2000
4000 km


North America (161 locations)
Northern Europe (18 locations)
East Asia (69 locations)
Central America (10 locations)
Central Europe (34 locations)
Southeast Asia (71 locations)
South America (22 locations)
Southern Europe (63 locations)
Australia (3 locations)
Cold-related excess mortality
Heat-related excess mortality
Excess mortality (%)
0
5
10
15
1990s
2010s
2030s
2050s
2070s
2090s
RCP2.6
RCP4.5
RCP8.5

- The Intergovernmental Panel on Climate Change (IPCC) has concluded that to avert catastrophic health impacts and prevent millions of climate change-related deaths, the world must limit temperature rise to 1.5°C.

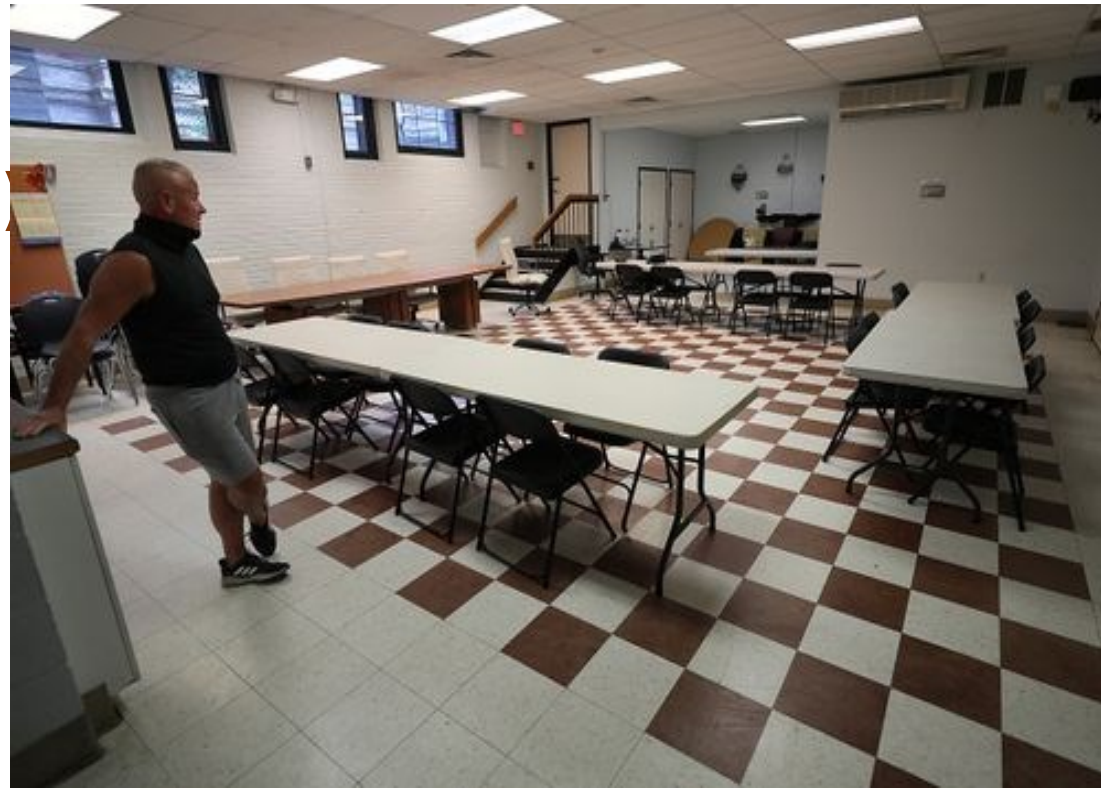
Who & where will be more at risk?

- No one is safe, However

the people whose health is being harmed first and worst by the climate crisis are the people who contribute least to its causes, and who are least able to protect themselves and their families against it - people in low-income countries and communities.

- **Reducing emissions of greenhouse gases through better transport, food and energy-use choices can result in improved health, particularly through reduced air pollution**

  - **Heat Health Warning System**
  - **Air conditioners(Chicago, Emit Heat, use electricity, Coling centers)**
  - **Planting trees**
  - **local action (Risk Maps, Education ,..)**



Heat Health Warning System

- A heat health warning system is a ‘system that uses meteorological forecasts to initiate acute public health interventions

- Interventions include media announcements, opening of cooling centers, home visits or telephone calls to vulnerable people, and website bulletins. Such interventions have been shown to reduce excess mortality

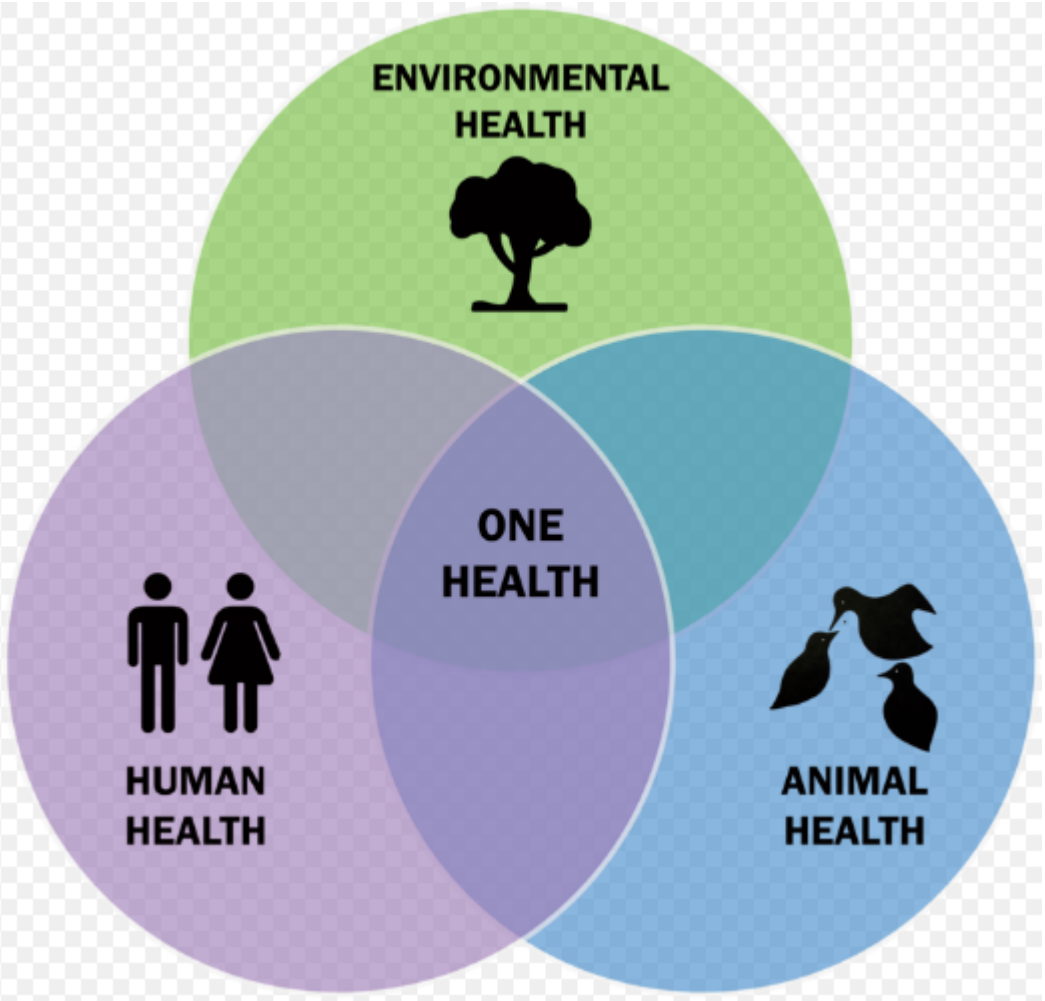
Environmental Sustainability of Health Systems

Bakhtiar Piroozi
Assistant Professor of Health Policy
Social Determinants of Health Research Center
Research Institute for Health Development
Kurdistan University of Medical Sciences

One Health

World Health Organization

- 'One Health' is an integrated, unifying approach to balance and optimize the health of people, animals and the environment.
- One Health is a collaborative, multisectoral, and transdisciplinary approach with the goal of achieving optimal health outcomes recognizing the interconnection between people, animals, plants, and their shared environment.



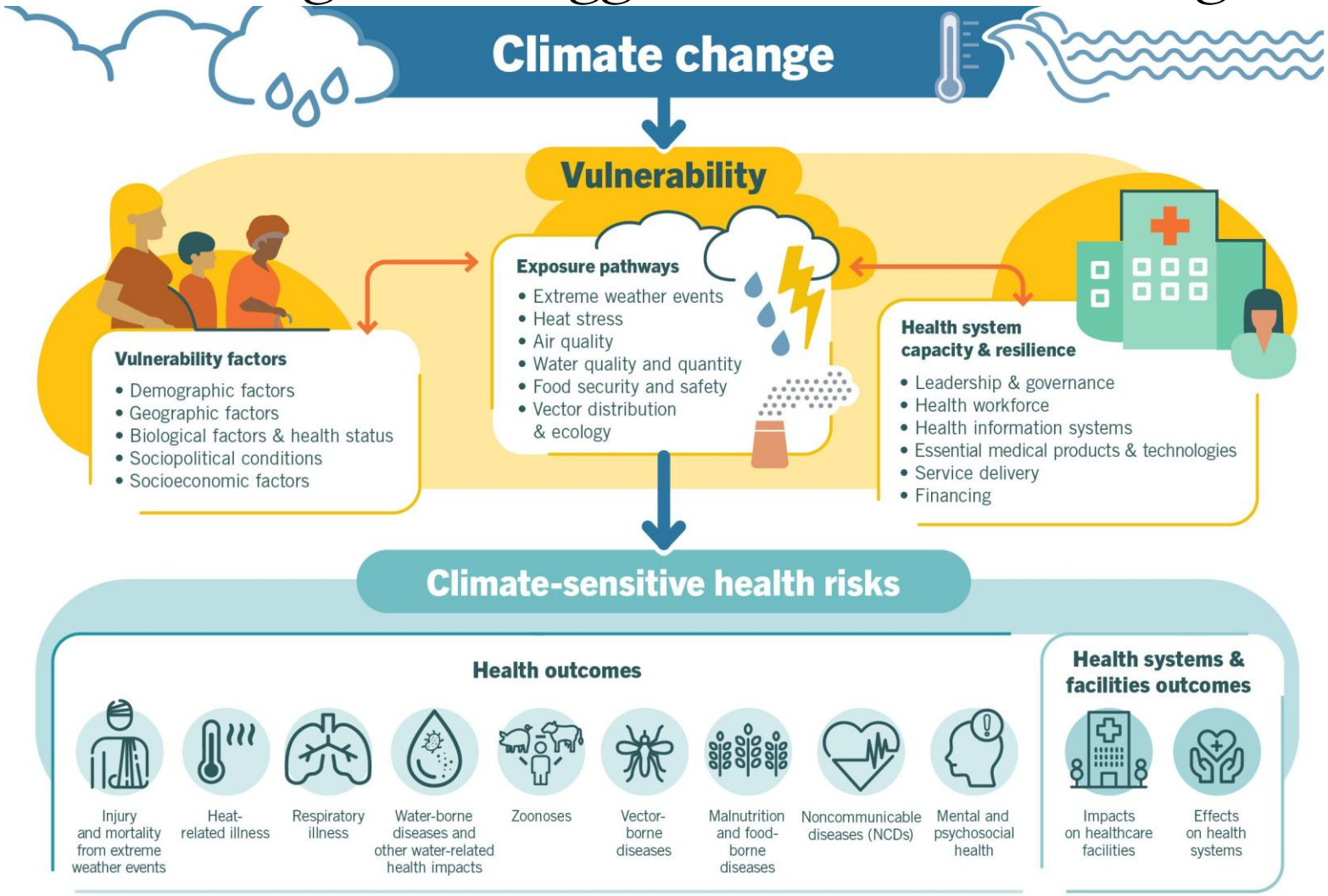
Sustainable Development Goals (SDG)

SDG13 Climate Action

- SDG13 calls for urgent action to combat climate change and its impacts. Scientists and policymakers have set a goal of limiting global warming to 1.5°C above pre-industrial levels. Today, the planet is only 0.4°C from that mark. On average, each person accounts for 6.2 tones of CO2 emissions. But in many countries, the number is three times greater.

Climate change and health

- Climate change – the biggest health threat facing humanity



Environmental sustainability of health systems

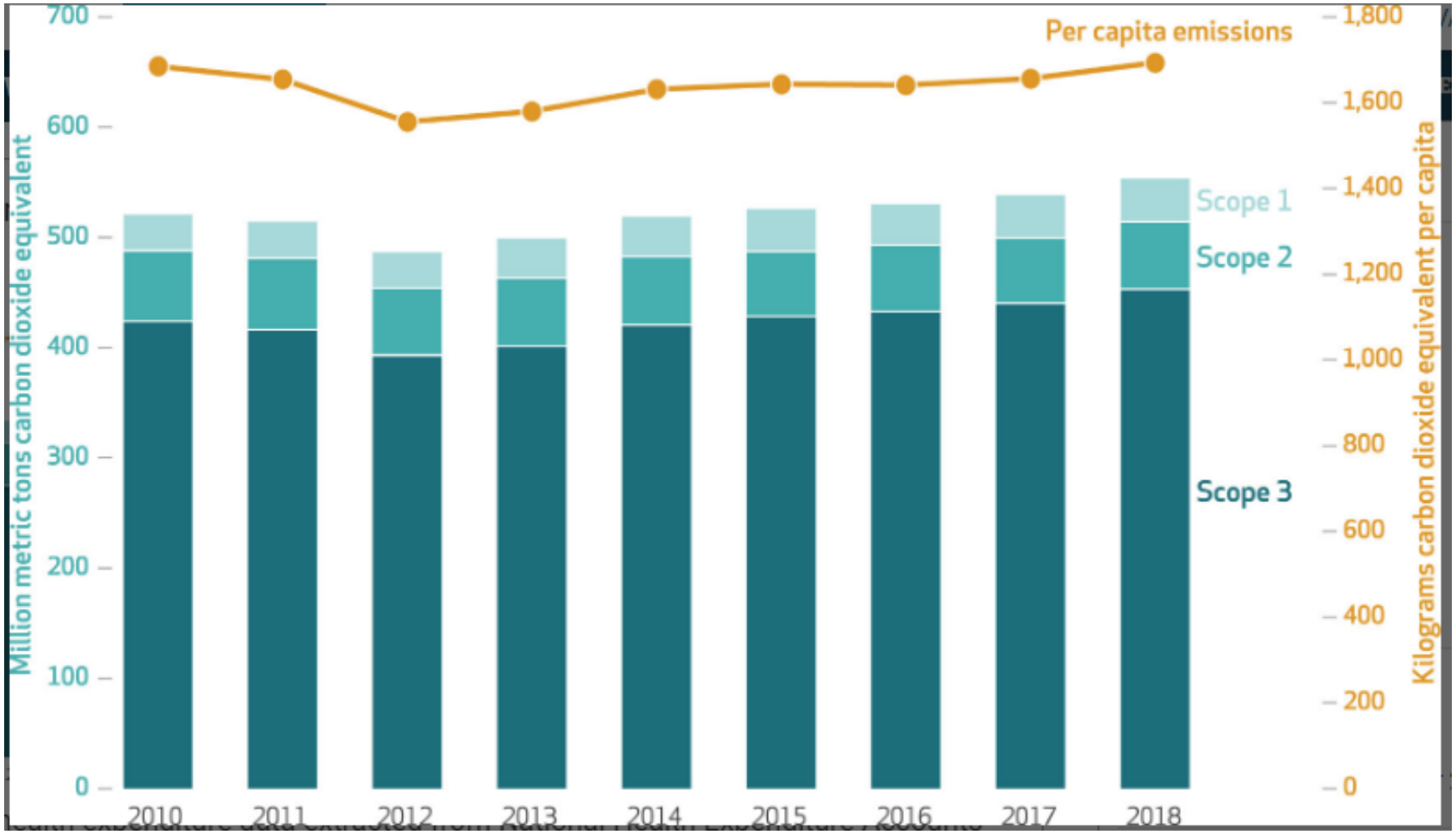
- The health-care sector faces a great climate change paradox: health-care facilities and health-care givers are responsible for providing care to those who face harm and illness caused by climate change, but health systems also bear responsibility for the extensive environmental waste and contamination that contribute to these threats.
- Health care contributes nearly 5% of greenhouse gas emissions globally; and if the sector was a country, it would be the fifth largest polluter in the world.

The WHO Health Systems Framework

US national health care greenhouse gas emissions

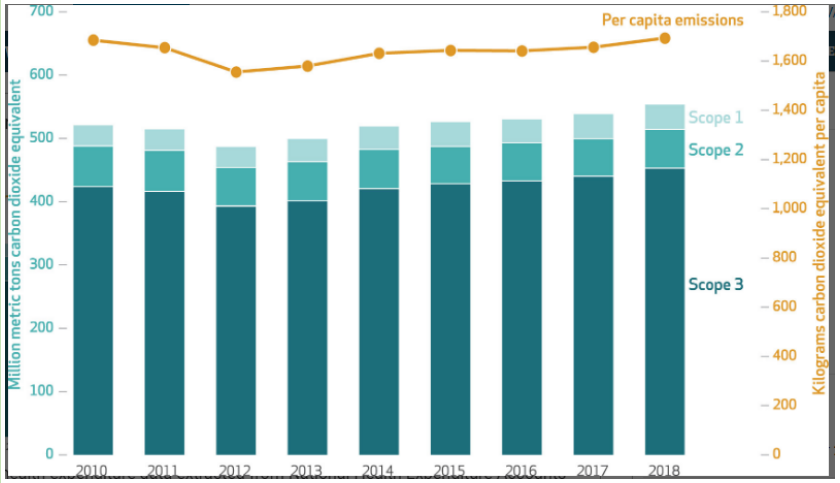
- Greenhouse gas (GHG) emissions of 614 million metric tons of carbon dioxide equivalents in 2013.
- Economy wide modeling showed that US health care greenhouse gas emissions rose 6 percent from 2010 to 2018, reaching 1,692 kg per capita in 2018—the highest rate among industrialized nations.
- Annual GHG emissions associated with health care in the United States would cause 123 000 to 381 000 disability-adjusted life-years (DALY)
- Health care sector is responsible for 4.4–4.6 percent of worldwide greenhouse gas emissions.
- The US health care system is responsible for about a quarter of all global health care greenhouse gas emissions, which is more than the health care system of any other nation.
- Health damages stemming from US health care pollution in 2013 (the most recent study) were on the same order of magnitude as deaths from preventable medical errors.

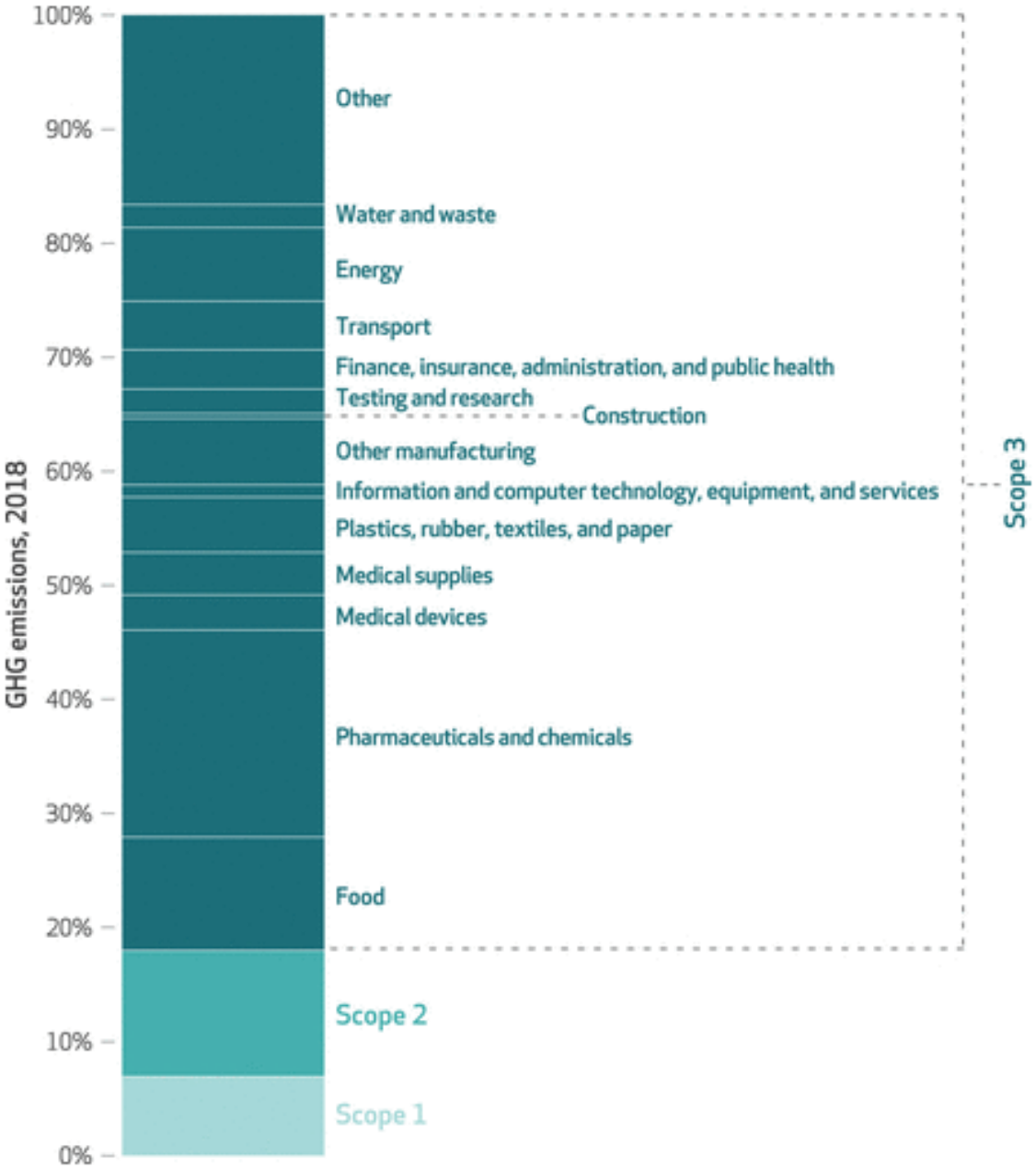
US national health care greenhouse gas emissions



- NOTES Scope 1 is direct emissions from health care facilities, Scope 2 is emissions from direct purchases of energy, and Scope 3 is all other supply-chain emissions.

US national health care greenhouse gas emissions





Sustainable Health System

"A sustainable health system improves, maintains, or restores health, while minimizing negative impacts on the environment and leveraging opportunities to restore and improve it, to the benefit of the health and well-being of current and future generations."

- WHO, 2017

ENVIRONMENTAL IMPACTS AND PRESSURES

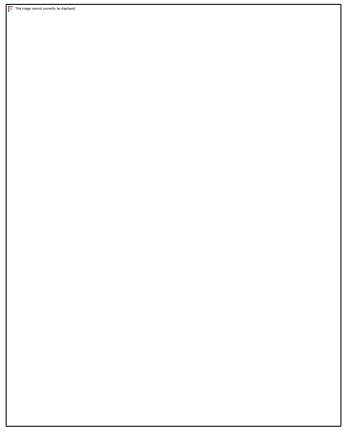
- There is clear evidence that health system activities entail significant impacts and pressures on the environment. These include the generation of hazardous and conventional waste, wastewater and greenhouse gas emissions, and the high consumption of resources (for example, water and energy).

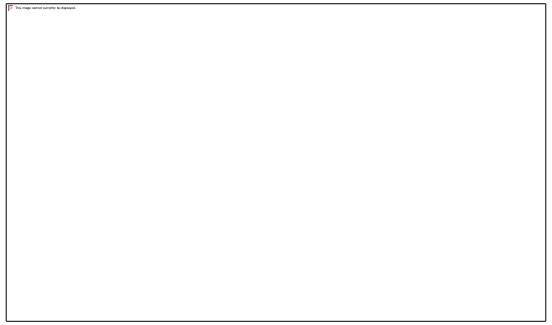
ENVIRONMENTAL IMPACTS AND PRESSURES

- Health-care waste
- Greenhouse gas emissions:

an average hospital patient generating 45 kg of carbon emissions per day

- Wastewater
- Resource consumption – water and energy
- Toxic chemicals





OPPORTUNITIES AND BENEFITS

- As environmental sustainability is more widely mainstreamed, the opportunities and benefits it entails in health systems are becoming more apparent. This evidence complements a large body of knowledge on the general benefits of environmental sustainability in large organizations within various sectors, both private and public.

OPPORTUNITIES AND BENEFITS

- Health protection and promotion
- Financial benefits/Reducing costs
- Reducing burden of diseases
- Improve efficiency
- Increase the resilience of health systems
- Provide benefits for patients, providers, the health workforce and health systems' core functions
- Decrease environmental health risks

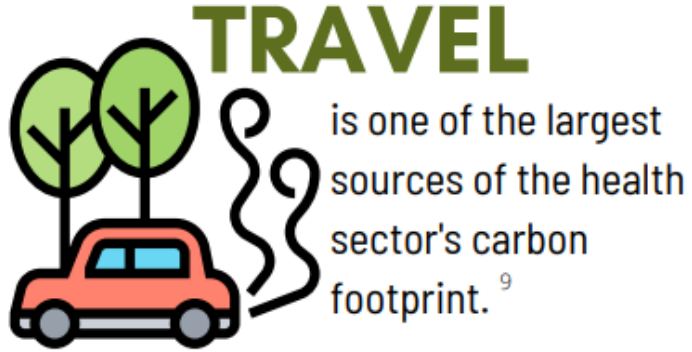
ENABLERS AND BARRIERS

- The existing evidence also points to certain factors that either enable or hinder progress in fostering ESHS. These can be divided into the following three main categories (WHO, 2016).

- Individual-level barriers and enablers
- Organizational-level barriers and enable
- System-level barriers and enablers

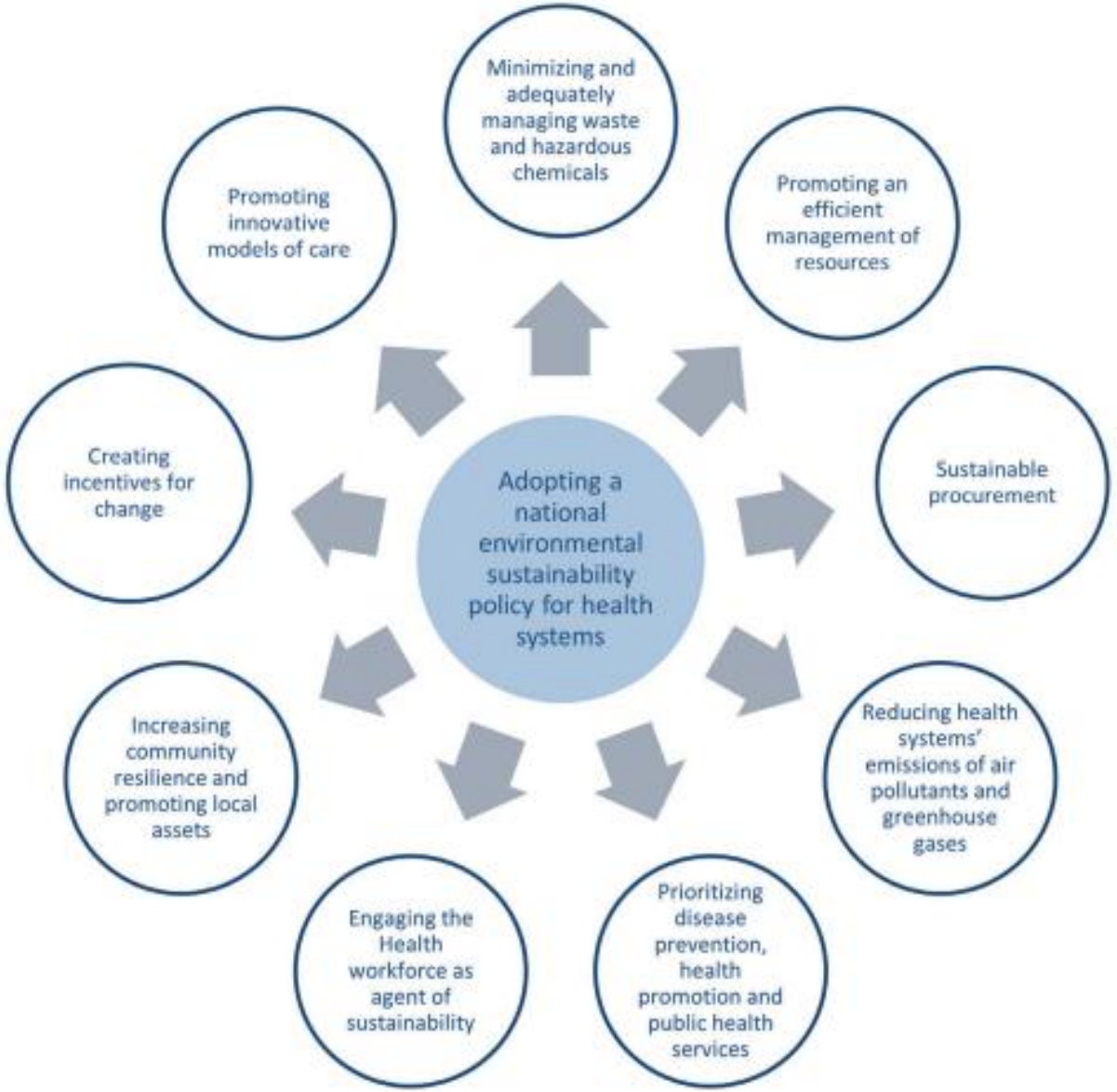
Characteristics of (How to built) an environmentally sustainable health system

- Renewable energy sources
- Minimize carbon footprint
- Waste reduction and recycling (Reduce, Reuse, Recycle)
- Sustainable transportation
- Education and awareness
- Energy efficiency
- Sustainable procurement
- Water conservation
- Green infrastructure
- Climate change adaptation
- Regular monitoring, evaluation, and improvement of sustainability initiatives



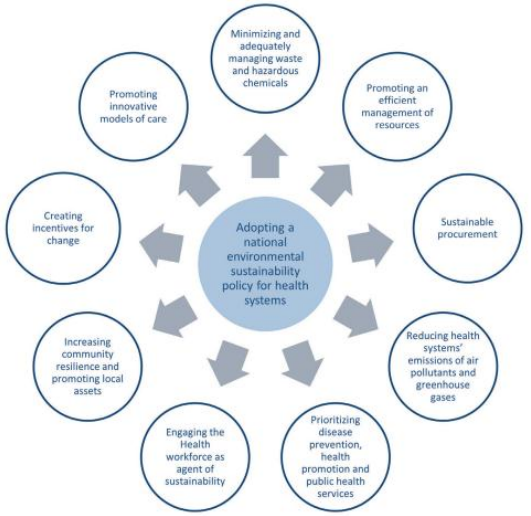
GreenCare

Possible elements of a national environmental sustainability policy for health systems



Ten avenues for action are proposed that can form the core of a strategy for fostering environmental sustainability in health systems

- Minimizing and adequately managing waste and hazardous chemicals;
- Promoting an efficient management of resources (WASH, Building, Energy);
- Promoting sustainable procurement;
- Reducing health systems' emissions of greenhouse gases and air pollution;
- Prioritizing disease prevention, health promotion and public health services;
- Promoting innovative models of care
- Engaging the health workforce as an agent of sustainability;
- Increasing community resilience and promoting local assets;
- Creating incentives for change; and



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