

CLIMATE CHANGE AND IMPACT ON HUMAN HEALTH

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History of climate change

- Climate change, a phenomenon not only of modern times, occurs today at a faster pace.
- It is attributed to both natural and anthropogenic factors.

Factors influencing climate

Key factors :

- (a) **orbital** changes in the “Earth-Sun” system (trajectory changes causing differentiation of the distance from Sun, changes in the skew angle of earth’s rotation axis)
- (b) changes in the “**Lithosphere-Hydrosphere-Atmosphere**” system
- (c) qualitative and quantitative changes in both the incoming and outgoing **radiation** inside the universe
- (d) changes in **volcanic activity** and in the creation of glaciers
- (e) changes in the concentration of **greenhouse gases** in the atmosphere
- (f)³ human impacts

Factors of climate change

Climatic conditions on Earth are directly affected **by both** :

- external (solar) and
- internal (oceanic) mechanisms

but also by

anthropogenic effects of our times, which influence considerably the global climate.

Anthropogenic parameters

- Over the past 50 years large quantities of CO₂ and other greenhouse gases have been released by human activities, especially the burning of fossil fuels
- These gases trap more and more heat in the atmosphere, which affects the global climate.
- The quantity of pollutants emitted today in the atmosphere is almost double that emitted in 1970.

- Air pollutants
- The temperature increase of the planet is not only due to pollutants like carbon dioxide, methane and nitrous oxides. Recent surveys have shown that the increase in temperature is also due to **suspended particles** emitted from vehicles and industry.
- The **suspended particles** change the white color of the glaciers' surface into gray. This reduces reflection of sun light, thus trapping heat which increases temperature and finally melts faster the polar caps.

According to the European Environmental Agency (EEA):

- Road transport is responsible for 17.5% of the total emission of greenhouse gases in Europe
- emissions from the transport sector have increased by 23% between 1990 and 2009

A very important factor for the climate change is **the water** as it participates in both ways :

- it **can cause** climate change
- it **is affected** by climate change

The changes in the water cycle affect the lifestyle, the flora and fauna, agriculture and the consumption of the water itself.

According to the results of investigations in the countries of the Mediterranean, the Middle East and Central Asia, it cannot be ruled out that regional conflicts about water erupt in the future.

The Intergovernmental Commission of United Nations for the Climate Change has drawn attention on the fact that **extreme weather conditions** such as

- storms
- flooding

are now more **frequent** and more **intense** (hurricanes "Sandy", "Haiyan")

NASA experts are stressing that
“the more the atmosphere is warmed up,
the more moisture from the water
evaporation is generated”.

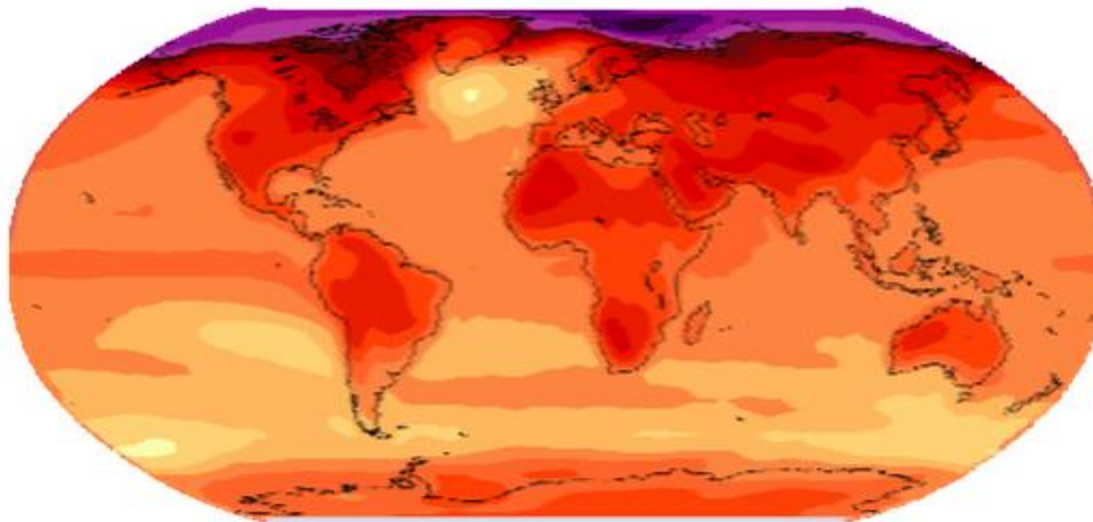
And it should be noted that :

*Humidity is the "fuel" of weather
phenomena*

the more wet the atmosphere is turning,
the greater the potential for extreme
weather conditions becomes

Global distribution of surface warming

Geographical pattern of surface warming



(°C)

Different countries experience climate change impacts to different degrees.

Mathematical models to simulate climate change

First climate models were developed in late 19th century by the Swedish Physicist **Svante Arrhenius** , after his observation of large CO₂ emissions.

Equations are solved using a three dimensional grid extending from the depths of the sea until the Space, thus including the entire globe.

In a study carried out by the Climate Change Watch of the National Observatory Athens (NOA), it is foreseen that within the period 2071 – 2100 Greece will experience

a 7⁰C to 10⁰C temperature increase

and

a 30% to 40% rainfall reduction

This study , the first of its kind carried out by a Greek scientific entity, was based on a climate simulation model.

Until 2080 approximately 100 million people each year **will leave their homes**, because the sea will cover the areas where they used to live. They will be the environmental refugees.

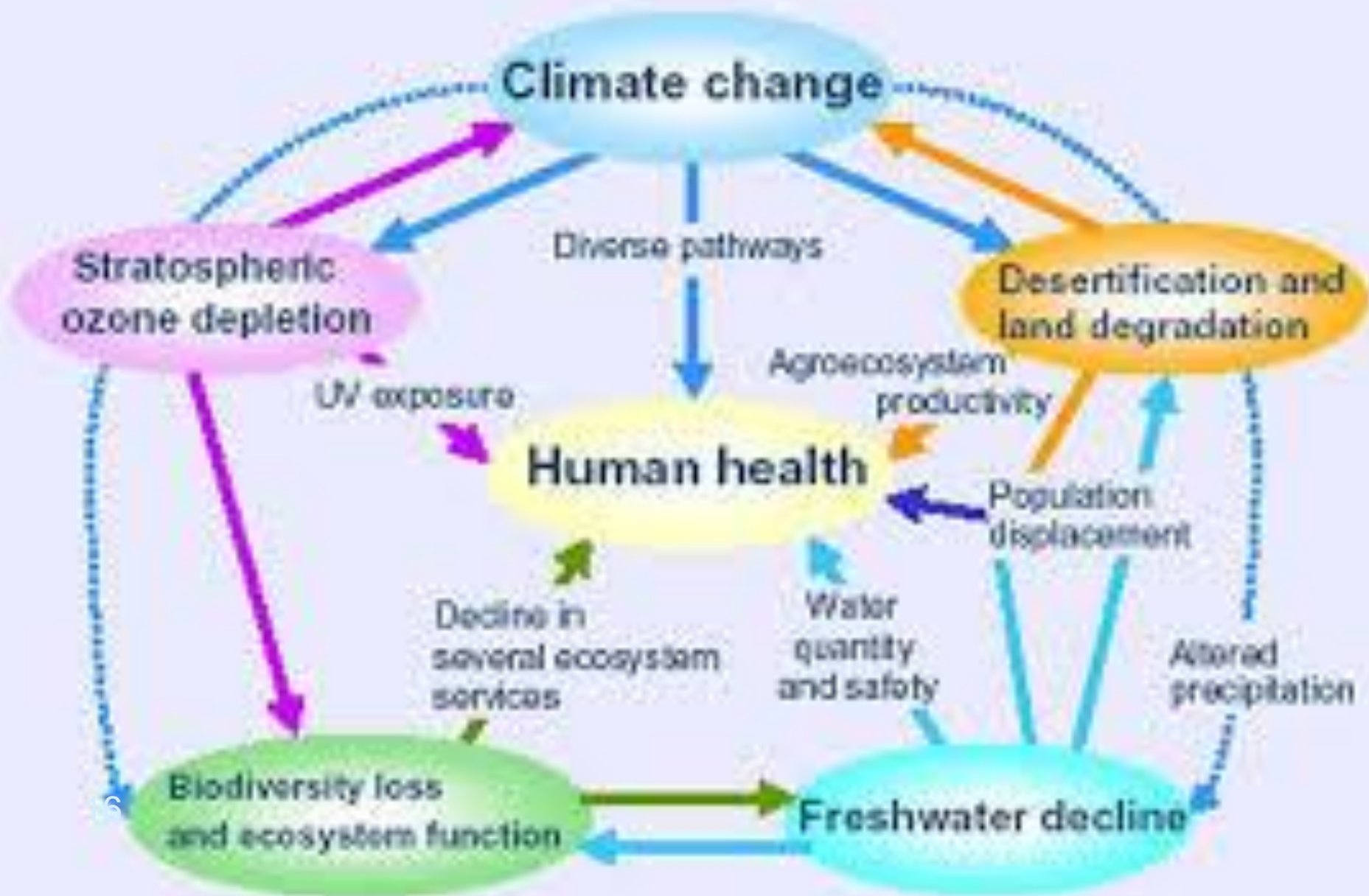
Moreover up to 1/3 of wild life on the planet will come in danger of extinction, even with a moderate temperature raise.

The temperature increase and the changes in global rainfall pattern are expected to affect the **agricultural production**, which could reduce the **food availability**.

Impacts of climate change

- Extreme variations in weather conditions
- Heat waves
- Heavy rainfall
- Floods
- Drought
- Severe storms
- Hurricanes and typhoons
- Raise of sea level
- ¹⁵ Increased atmospheric pollution

Climate change and health



According to a study published on 3.12.09 by "Lancet" and the Institute for Global Health at University College London, climate change is the most severe threat to the human health in the 21st century.

It will be a threat to the **life of people** all over the world, yet the poorest countries will be most adversely affected, despite the fact that they have a smaller contribution to the problem.

According to the study, climate change is causing six major threats to human health :

Climate change and impact on human health

Diseases

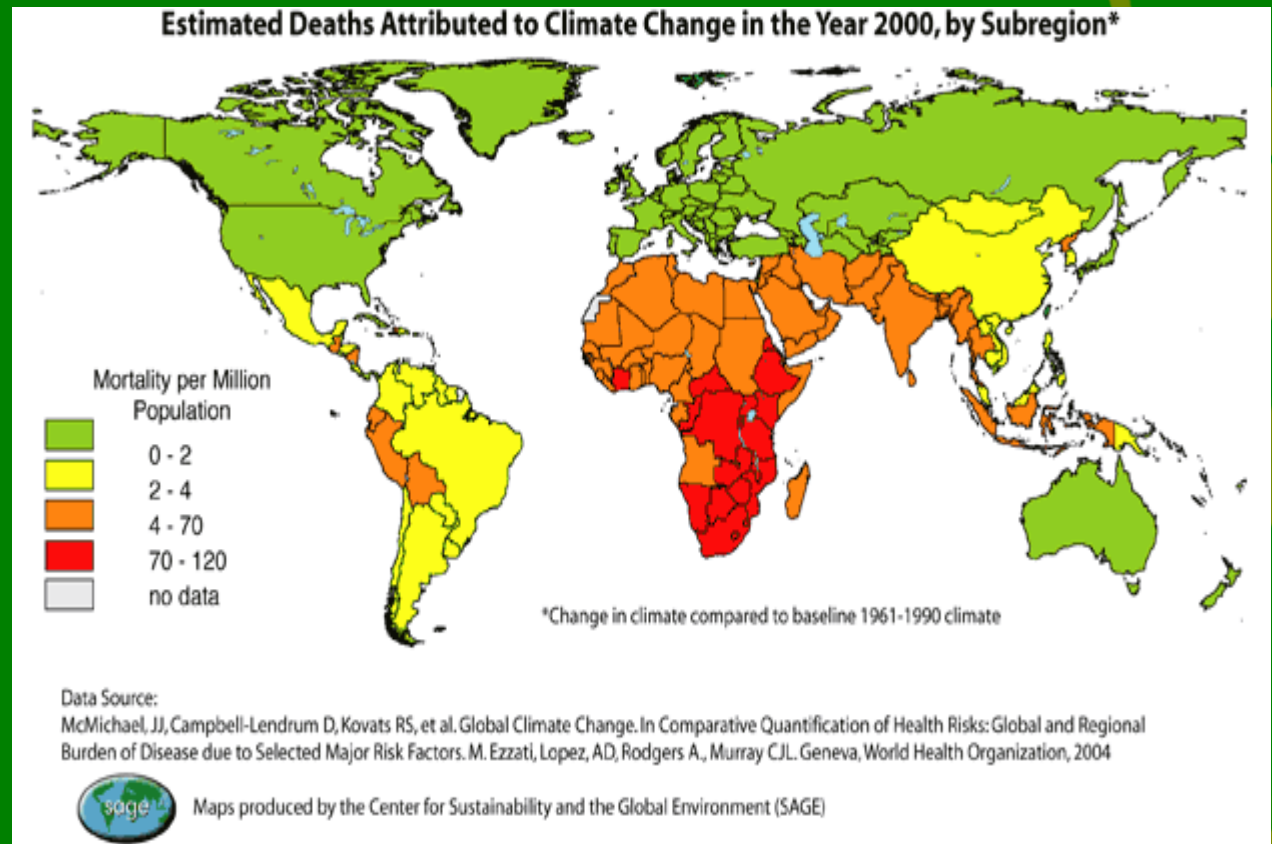
Food

Water and sanitation

Shelter and settlements

Extreme weather
events

Population and
immigration



More specifically, the six major threats are described as below :

Diseases: climate change will affect the quantities of the diseases transported by insects and rodents, not only in developing countries, which already have disease-plagued populations, but also in the developed ones.

For instance, it is estimated that 70,000 people died in 2003 from the heat wave in Europe.

Food: The climate change affects health by influencing human nutrition in a way leading to malnutrition or hunger. This is because of increased food scarcity, particularly in the poorest countries.

Water and hygiene: Clean water, appropriate hygiene conditions and sewage disposal systems are adversely affected. Prolonged droughts will bring water shortages, while floods will lead to an increase in the diseases transported by the water, such as diarrhea.

Shelter and settlements: a particularly vulnerable group of people is those, who live in urban slums, in wretched conditions.

Extreme weather events: more and stronger storms, hurricanes and typhoons will cause floods and human casualties.

Population and migration: It is highly likely that large-scale migration occurs, as people will leave areas with unfavorable living conditions.

Study from Johns Hopkins School of Public Health and the USA Center for Disease Control and Prevention (CDC) - Impact on Public health :

- Diseases and deaths related to high temperature
- Impact on health caused by extreme weather events
- Impact on health due to atmospheric pollution
- Waterborne and food-borne diseases
- ₂ viral infections and diseases transmitted by insects and rodents

The increase in temperature, apart from the direct impact on human health (respiratory problems, thermal stress etc.), has also indirect impacts on it as the overall climate change is favoring the transmission of certain diseases.

In addition to the changes in the biosphere of the earth, malaria and other tropical diseases can now spread beyond their known appearance zones, owing to the temperature increase.

According to the European Environmental Agency (EEA) the increase in temperature allows for instance to some tick species (e.g. Ixodes Ricinus) to thrive even northern, while it may gradually also create in certain areas of Europe favorable conditions for mosquitoes and insects which are carriers of diseases.

The pollination period is nowadays greater as it starts now 10 days earlier than 50 years ago, which also affects the human health.

- The British Meteorological Service recently started to investigate the impact of climate change on the health of people in the cities :
- **HEAT WAVES**: For some can be deadly. Most victims are elderly, as they are more vulnerable to heat related exhaustion.
- **HEAVY COLD**: most threatened are persons with chronic diseases such as heart disease.
- **CLOUDY DAYS**: These days can lead to depression phenomena (Seasonal Emotional Disturbance).

Vulnerable groups

- the elderly
- Children
- people with chronic health problems under continuous medical monitoring
- poor people with inadequate nutrition or malnutrition living in low income areas with difficult access to health services.
- Residents of islands and mountainous areas, with water shortages and difficulty in securing a healthy diet
- Immigrants with limited or no access to the labor market & the social and health services.

Climate change events	Impact on human health	Vulnerable groups
Heat waves	Thermal stress	Elderly, sportlers, people with respiratory disorders
Extreme weather events, rain, hurricanes, floods	Injuries, drowning	Coastal regions, low altitude land areas
Draughts, floods, increase of the average temperature	Waterborne and foodborne diseases	Many population groups
Rising sea levels	Injuries, drowning, water and soil salinization	Coastal regions, low altitude land areas

Climate change events	Impact on human health	Vulnerable groups
Droughts, immigration of ecosystem	Lack of food and water, malnutrition	The elderly, the children
Extreme weather events, droughts	Mass population movement, international conflicts	Agricultural sector
Increase in the (ground or air) concentration of ozone, allergic factors and other pollutants	Wide outbreak of respiratory system diseases (asthma, chronic obstructive pulmonary disease etc.)	Elderly, children, persons with respiratory disorders
Climate change	Mental health	

According to the “Atlas of Health and Climate” by the World Meteorological Organization (WMO) and the World Health Organization (WHO) weather forecast and information about climate can help in preventing epidemics.

Climate variations and extreme weather events may trigger epidemics (diarrhea, meningitis, malaria, dengue fever etc.) able to kill millions and cause illness for hundreds of millions more.

Long-term climate change could exacerbate today’s problems and undermine future health systems, infrastructure, social protection systems and supplies of food, water, and other ecosystem products and services vital for human health.

In the "Atlas of Health and Climate" special emphasis is given on the way early provision can save lives.

For example, while in 1970 almost 500,000 people were killed in a cyclone that hit Bangladesh, proper preparations for a similar magnitude event five years ago, had as a result the loss of human life to be limited to just 3,000.

The **Atlas** of WHO aims to convey three key messages:

- 1. Climate affects the geographical and seasonal distribution of the major part of several diseases and may pose considerable threats to health security, on a time scale extending from some hours to centuries.
- 2. The relationship between health and climate is affected by many other vulnerabilities, such as the physiology and behavior of the individuals, the environmental and socio-economic conditions of the population, and the extension and effectiveness of health programs.
- 3. Climate information is now being used to protect public health through risk mitigation, adequate preparedness and availability of response within variable time and space extents, in both affluent and developing countries.

MITIGATION MEASURES

(Ministry of Environment & Climate Change)

Several measures are required to address climate change impacts. These include among others :

- the more **efficient use of scarce water resources**
- modification of current **building standards** so that new buildings can be resistant to future climatic conditions and extreme weather events
- the construction of **flood protection works** and the raising of **dykes** for protection from the sea level rise

MITIGATION MEASURES

(Ministry of Environment & Climate Change)
(*continued*)

- development of **drought resistant crops**
- choice of species and **forestry practices** less vulnerable to storms and forest fires
- development of **rural planning** and the establishment of corridors to facilitate the immigration of species

MITIGATION MEASURES

(Ministry of Environment & Climate Change)

(*continued*)

In general, actions may encompass both national and regional strategies, as well as practical measures at the level of Communities and Individuals.

Actions should relate to both the natural and human systems. (Green Paper, EU, 2007).

According to the World Health Organization (WHO) a new plan to address the impact of climate change includes :

- **Information**

to raise awareness that climate change is a fundamental threat to human health

- **Cooperation**

with partner organizations in the framework of the United Nations system

(continued)

- **Scientific documentation**

Coordination of scientific data evaluations and development of a global research program

- **Strengthening of the health system**

to help the countries in assessing vulnerabilities of their health system and in making the public health less vulnerable to climate change impacts