Modern problems of human ecology. Genetics of ecology

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Lecture plan:

1. Basic concepts of ecology
2. Ecological factors
3. Anthropoecology
4. Anthropoecosystems
5. Structure of anthropoecosystems
6. Ecological problems of XXI century
7. Classification of harmful substances
8. Sources of air pollution
9. Sources of water pollution
10. Residential pollutants
11. Food ecology
12. Genetically modified foods (biotech food) and preservatives
13. Diseases ecology
14. Influence of environment on inheritance
15. Save the environment

Basic concepts of ecology

- Ecology is the branch of biology which studies the interactions organisms and their environment.
- Ecology is divided into following types:

- **Autecology** studies interaction of a individual organism or a single species with the environment;

- **Synecology** studies interaction of plant or animal communities with the environment;

- **Demecology** studies the interaction of populations of individuals of the same species with the environment.

Ecological factors

- Ecological factors are any habitat factors that have any effect on living organism.

Classification of environmental factors

- **By nature of exposure**

- *Directly acting* - directly affecting the body, mainly on the metabolism;
- *Indirectly acting* - influencing indirectly, through the change of directly acting factors (relief, exposure, height above sea level, etc.);
- *Conditionally acting* - the influence of ecosystem elements (biogeocenosis), strengthened or weakened by the action of other environmental factors.

Classification of environmental factors

- **By origin**

- *Abiotic* - factors of inanimate nature:

--climatic: annual sum of temperatures, average annual temperature, humidity, air pressure;

--edaphic (edaphogenic): soil mechanical composition, soil air permeability, soil acidity, soil chemical composition;

--orographic: relief, elevation, slope and exposure of the slope

--chemical: gas composition of air, salt composition of water, concentration, acidity;

--physical: noise, magnetic fields, thermal conductivity and heat capacity, radioactivity, intensity of solar radiation;

---hydrographic: water density, flow, transparency, etc;

---pyrogenic : fire factors.

Classification of environmental factors

- *Biotic* - associated with the activities of living organisms:

--phytogenic - plant influence;

--mycogenic - the influence of fungi;

--zoogenic - animal influence;

--microbiogenic - the effect of microorganisms.

- *Anthropogenic* (anthropic) factor - human impact on nature

The effect of environmental factors on the organism

Environmental factors affect the organism not separately, but in combination.

- - Monodominance - one of the factors inhibits the action of the others and its value is crucial for the organism. Thus, the complete absence or the presence of mineral nutrition elements in the soil, prevent the normal assimilation of other elements by plants.
- - Synergism - the mutual enhancement of several factors, due to positive feedback. For example, soil moisture, nitrate content and lighting, while improving the provision of any of them, increase the effect of the other two.
- - Antagonism is the mutual extinction of several factors caused by negative feedback: an increase in the grasshopper population contributes to a decrease in food resources and its population is reduced.
- - Provocation is a combination of positive and negative effects for the organism, while the influence of the second is enhanced by the influence of the first. So, the earlier the thaw occurs, the more the plants suffer from subsequent frost.

ANTHROPOECOLOGY

- Anthropoecology (human ecology) is an interdisciplinary and transdisciplinary science study of the relationship between humans and their natural, social, and built environments.

The main tasks of anthropoecology:

- - The study of the health of people.
- - The study of the dynamics of health in the aspects of natural history and socio-economic development.
- - Forecast of the health status of future generations of people.
- - The study of the influence of individual environmental factors and their components on the health and livelihoods of human populations (urban, rural, etc.).
- - The study of the processes of preserving and restoring the health and social and labor potential of populations
- - Analysis of global and regional problems of human ecology.
- - Development of new methods of human ecology (space, biochemical, etc.).
- - Development of ways to improve the level of health and social and labor potential of the population.

The main tasks of anthropoecology:

- - The creation of anthropoecological monitoring (system of observations of changes in people's life processes due to the influence of various environmental factors on them, as well as observations and assessments of environmental conditions that affect public health, causing the spread of diseases).
- - Compilation of medical-geographical maps reflecting the territorial differentiation of diseases of the population associated with environmental degradation.
- - Comparison of medical-geographical maps with maps of environmental pollution and the establishment of a correlation between the nature and degree of pollution of various natural components of socio-ecosystems and the corresponding diseases of the population.

Anthropoecosystems

- An anthropoecosystem is an ecosystem in which human vital activity occurs.
- Anthropoecological studies are studies of various anthropoecosystems - urban, rural, tropical, arctic, forest, steppe, modern, primitive, past eras.
- A typical example of two neighboring anthropoecosystems is the city and the surrounding countryside (сельская местность).

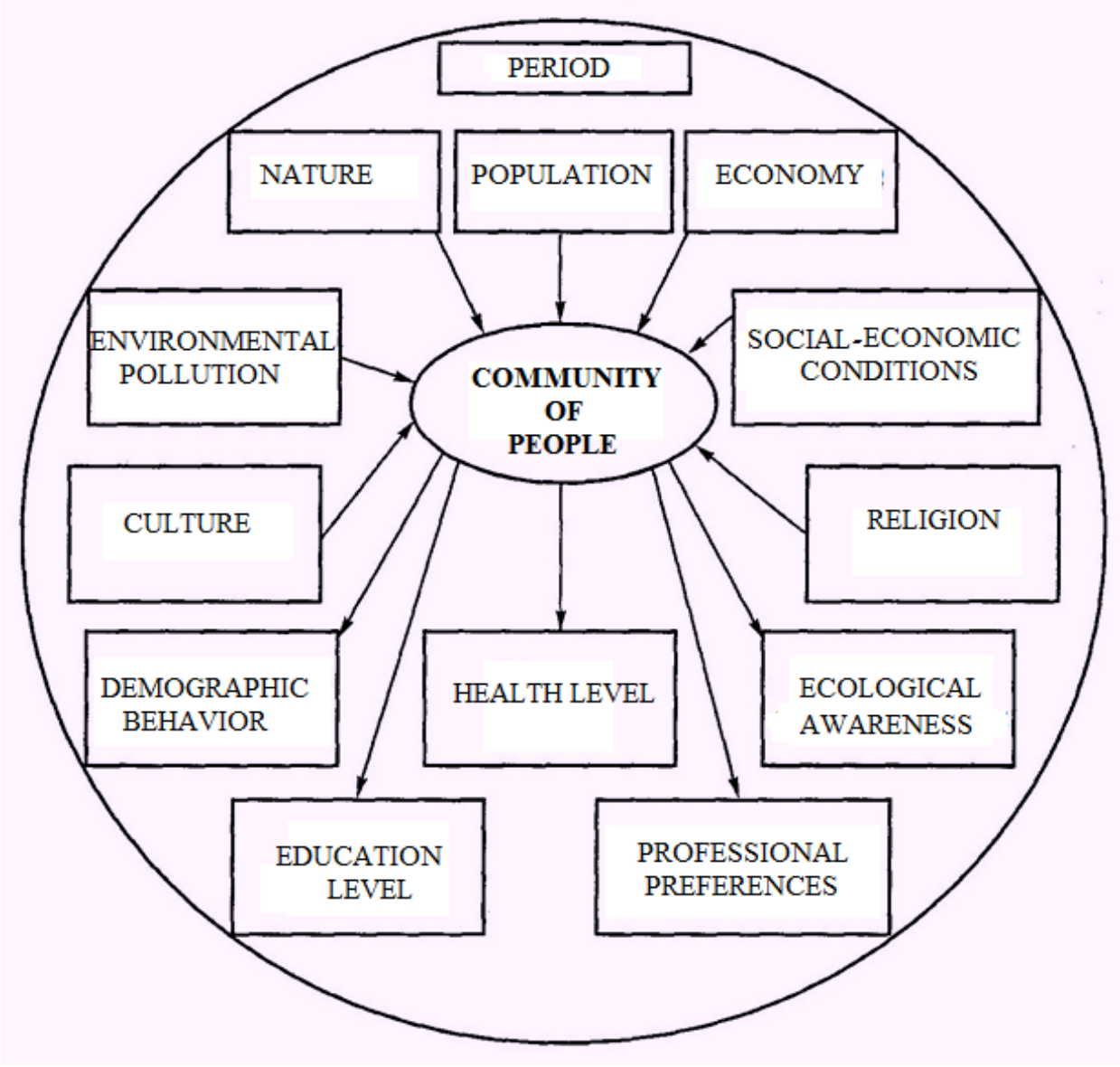
Anthropoecosystems

- There are anthropoecosystems of various levels:
  - **Global anthropoecosystem** - the entire biosphere, the entire population of the planet (human society), which uses the natural resources of the planet using technical means;
  - **Intermediate level anthropoecosystems** – country, federal district, economic region, city;
  - **Low level anthropoecosystems** - district, village, dwelling house.

Structure of anthropoecosystems

- Structure of anthropoecosystems can be represented as a model.
- At the center of the model is a community of people.
- The lifetime of each anthropoecosystem is limited and associated with social and economic changes.

Structure of anthropoecosystems



Structure of anthropoecosystems

- **A community of people** is an association of people.
- **Nature.** The most important parameters of the economy and the living conditions of the population are determined by nature, but at the same time it is under noticeable pressure from the economic activities of people.
- **Population**. The vital activity of any community of people is closely connected with the rest of the population.

Structure of anthropoecosystems

- **Economy** is a process of interrelations between human society and nature, as a result of which people obtain for themselves the necessary means of subsistence.
- **Social-economic conditions**. Information about the amount of living space per person, the level of wages, the population's cash income, the average amount of pensions, unemployment, crime, the composition of food rations and their value, etc.
- A **culture** is formed by generalizing the experience of many generations, as a result of the material and spiritual activities of all classes, groups and individuals that make up society.
- **Religion.** Undoubtedly, the influence of religion on the livelihoods of people, on attitudes towards their own health and the health of loved ones, on attitudes toward nature, toward people, towards cultural heritage and other faiths, to problems of war and peace.

Structure of anthropoecosystems

- **Environmental pollution.**
- The **level of health** of the population is an indicator of the adaptation of a particular community of people to certain living conditions.
- **Demographic behaviour**. The basic concepts of demography include: birth rate, mortality rate, natural movement of the population, life expectancy, life potential of the population, migration of the population.
- **Ecological consciousness**. It means an understanding of the inseparable connection of the human community with nature, the dependence of people's well-being on the integrity and comparative invariability of the natural environment conducive to practical activity.

Structure of anthropoecosystems

- **Professional preference**. Living conditions significantly influence the choice of occupations within communities of people. At the same time, the decisive role belongs to both natural and social-economic conditions. Natural resources in the habitat of the human community largely determine the occupation of people.
- **The level of education**.

Ecological problems of XXI century

- **Natural pollution**

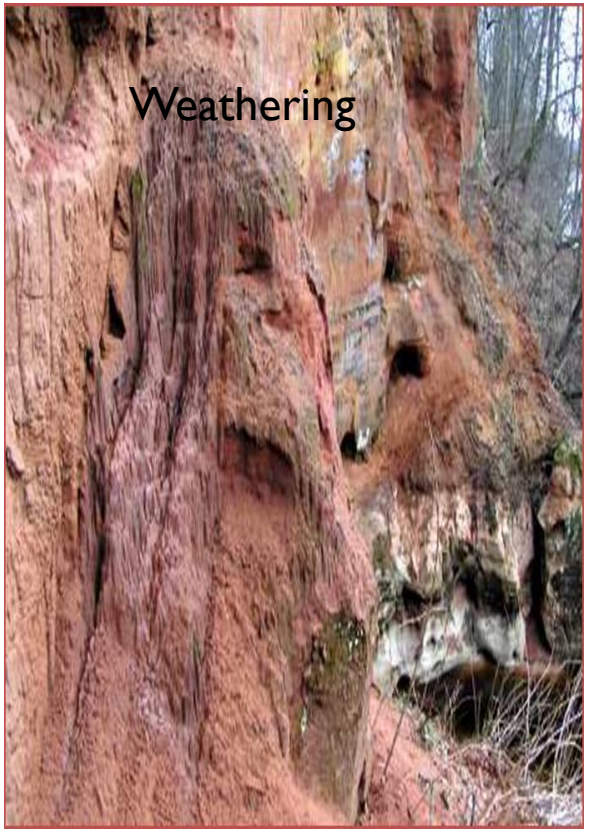
1. Forest fires
2. Dust storms
3. Volcanism
4. Weathering
5. Decomposition of dead organisms


Dust storms


Volcanism


Forest
fires


Decomposition of
dead organisms


Weathering

Ecological problems of XXI century

- **Anthropogenic pollution**

1. Factories
2. Thermal Power
3. Vehicles
4. Aircraft
5. House heating


vehicles


Factories


Aircraft


Thermal Power


House heating

Ecological problems of XXI century

- **Smog** is a kind of air pollution, originally named for the mixture of smoke and fog in the air.
- This kind of visible air pollution is composed of nitrogen oxides, sulphur oxides, ozone, smoke and other particulates.

Ecological problems of XXI century

- **Acid rain** is caused by a chemical reaction that begins when compounds like sulfur dioxide and nitrogen oxides are released into the air. These substances can rise very high into the atmosphere, where they mix and react with water, oxygen, and other chemicals to form more acidic pollutants, known as acid rain.

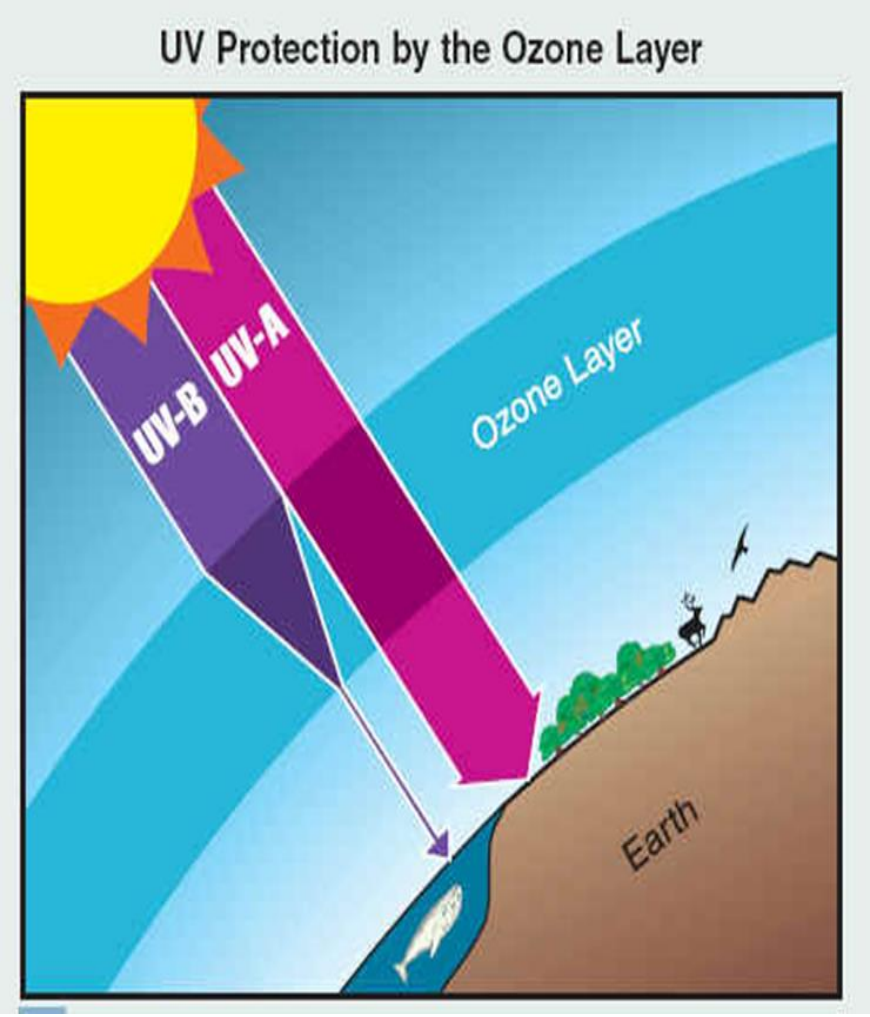
Acid rain

Ecological problems of XXI century

- **Ozone depletion**, gradual thinning of Earth's ozone layer in the upper atmosphere caused by the release of chemical compounds containing gaseous chlorine or bromine from industry and other human activities.
- A severe depletion of ozone in a region of the ozone layer, occurs particularly over Antarctica and over the Arctic.

Ozone depletion

- UV-B radiation (280- to 315-nanometer (nm) wavelength) from the Sun is partially absorbed in ozone layer. As a result, the amount of UV-B reaching Earth's surface is greatly reduced. Human exposure to UV-B increases the risk of skin cancer, cataracts, and a suppressed immune system. UV-B exposure can also damage terrestrial plant life, single cell organisms, and aquatic ecosystems.
- UV-A (315- to 400-nm wavelength) and other solar radiation are not strongly absorbed by the ozone layer.

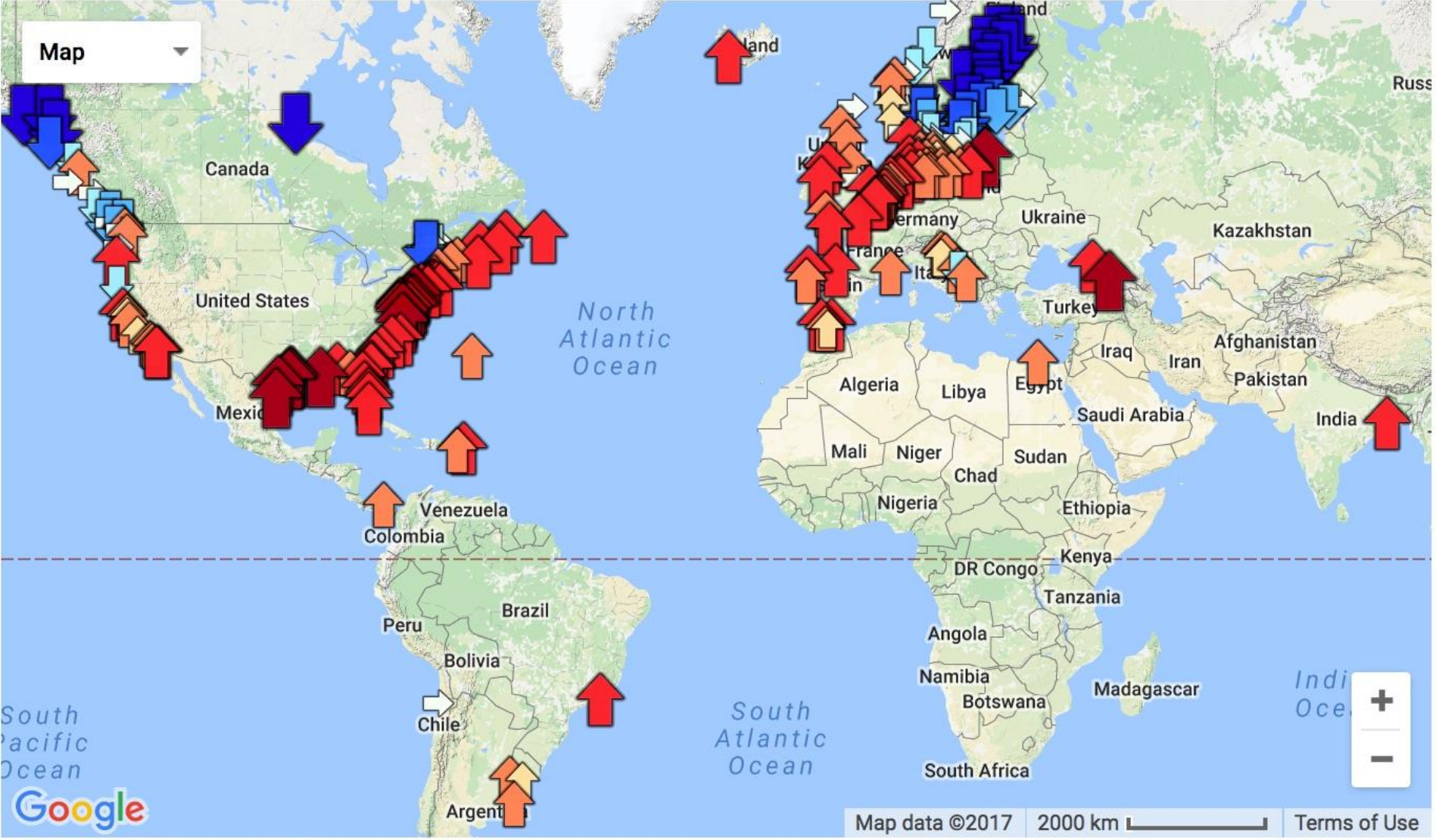


Ecological problems of XXI century

- **Glacial melt.** Since the early 1900s, many glaciers around the world have been rapidly melting. Human activities are at the root of this phenomenon.
- Rapid glacial melt in Antarctica and Greenland also influences ocean currents, as massive amounts of very cold glacial-melt water entering warmer ocean waters is slowing ocean currents. And as ice on land melts, sea levels will continue to rise.

Ecological problems of XXI century

- **Sea level rise.** Since at least the start of the 20th century, the average global sea level has been rising. Between 1900 and 2016, the sea level rose by 16–21 cm.
- This acceleration is due mostly to human-caused global warming, which is driving thermal expansion of seawater and the melting of land-based ice sheets and glaciers.
- Between 1993 and 2018, thermal expansion of the oceans contributed 42% to sea level rise; the melting of temperate glaciers, 21%; Greenland, 15%; and Antarctica, 8%. Climate scientists expect the rate to further accelerate during the 21st century.



< -4	< -2	< -1	< -0.5	-0.5 to +0.5	> +0.5	> +1	> +2	> +4

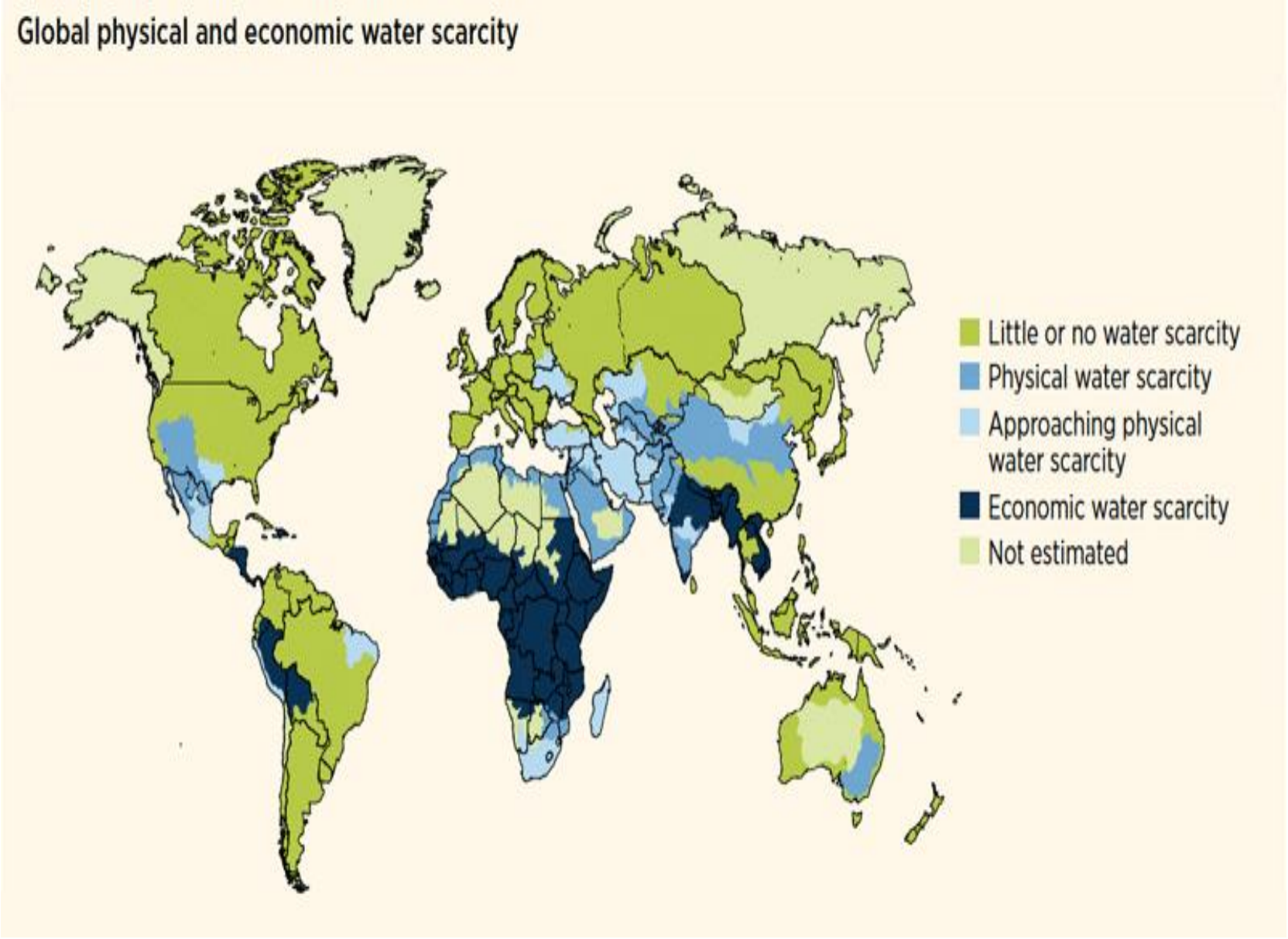
Trend, mm/yr

Start Year: 1960 End Year: 2015

Ecological problems of XXI century

- **Water scarcity** is the lack of fresh water resources to meet water demand. It affects every continent and was listed in 2019 by the World Economic Forum as one of the largest global risks in terms of potential impact over the next decade.
- A mere 0.014% of all water on Earth is both fresh and easily accessible. Of the remaining water, 97% is saline and a little less than 3% is hard to access.
- The increasing world population, improving living standards, changing consumption patterns, and expansion of irrigated agriculture are the main driving forces for the rising global demand for water.

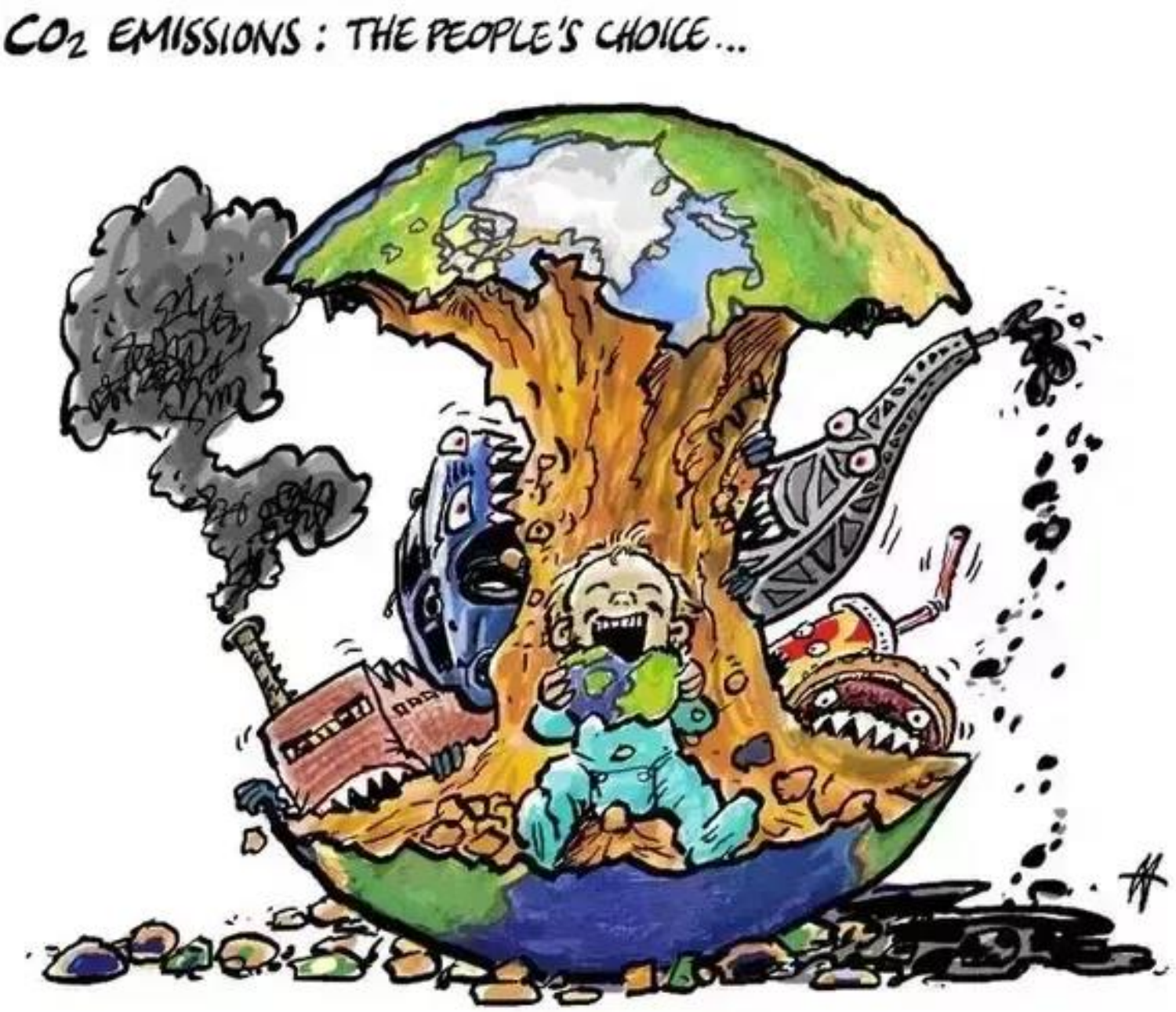
Water scarcity



Ecological problems of XXI century

- Environmental pollution is defined as "the contamination of the physical and biological components of the earth/atmosphere system to such an extent that normal environmental processes are adversely affected.
- Causes of environmental pollution:

- harmful smoke of vehicles causes air pollution.
- The combustion of fossil fuels pollutes the air, the soil and the water with noxious gases such as CO2 and CO.
- Agricultural waste: Fertilizers and pesticides used in agriculture are key causes of environmental pollution.


CO_2 EMISSIONS : THE PEOPLE'S CHOICE...

Classification of harmful substances

- **General toxic substances** that cause poisoning of the whole organism (CO2, Pb, Hg, C6H6, As and its compounds, etc.).
- **Irritating substances** that cause irritation of the respiratory tract and mucous membranes (Cl, NH3, SO2, O3).
- **Sensitizing substances** are act as allergens (various solvents and varnishes, formaldehyde).
- **Carcinogenic substances** that cause the development of cancer (Be and its compounds, benzopyrene, etc.).
- **Mutagenic substances** lead to a violation of the genetic code, a change in hereditary information (Pb, Mn, radioactive isotopes, etc.).
- **Substances affecting reproductive function** (Hg, Pb, styrene, radioactive isotopes, etc.).

Sources of air pollution

- **Natural sources:**

- Dust is made of fine particles of solid matter. On Earth, it generally consists of particles in the atmosphere that come from various sources such as soil, dust lifted by wind, volcanic eruptions, and pollution.

-Methane, emitted by the digestion of food by animals, for example cattle.

-Radon gas from radioactive decay within the Earth's crust. Radon gas from natural sources can accumulate in buildings, especially in confined areas such as the basement and it is the second most frequent cause of lung cancer, after cigarette smoking.

-Smoke and carbon monoxide from wildfires.

-Volcanic activity, which produces sulphur, chlorine, and ash particulates.

Sources of air pollution

- Anthropogenic (man-made) sources:

-Mobile sources include motor vehicles, marine vessels, and aircraft.

-Manufacture sourses are generated as emissions from technological processes, heating;

-Household pollutants caused by the burning of fuel in the home and the processing of household waste.

SOURCES OF WATER POLLUTION

- **Surface water pollution** includes pollution of rivers, lakes.
- **Marine pollution**.One common path of entry by contaminants to the sea are rivers. An example is directly discharging sewage and industrial waste into the ocean. Pollution such as this occurs particularly in developing nations.
- **Groundwater pollution**. Interactions between groundwater and surface water are complex. Analysis of groundwater contamination may focus on soil characteristics and site geology, hydrogeology, hydrology, and the nature of the contaminants. Causes of groundwater pollution include: naturally-occurring (geogenic), on-site sanitation systems, sewage, fertilizers and pesticide, commercial and industrial leaks, landfill leachate.

SOURCES OF WATER POLLUTION

Residential (home) pollution

Residential pollution is the presence of hazardous materials or noises within a home that may negatively affect people.

- **Chemical:** The main sources of chemical pollution are usually furniture and building materials that emit phenol, formaldehyde and radon, which we have already talked about, as well as styrene and aerosols of heavy metals, which cause irritation of the mucous membranes, asthma, and malfunctioning of the liver and kidneys. The sources of chemical pollution are also detergents from washing dishes, common household cleaners.
- **Microbiological:** Our apartments are contaminated with dust, which accumulates furniture, carpets and home textiles. Dust is the home of dozens of species of living things, from ticks to bacteria. Another common misfortune is mold and fungus. All this not only spoils the interior, but also threatens health, causing asthma, allergies and weakened immunity.
- **Radiation** is deadly - it causes cancer. Sources of radiation can be the most unexpected objects. The increased radiation background is often inherent in products made of stone and clay, but in fact there can be anything "room Hiroshima". Do you suffer from headaches, insomnia, irritability and a constant feeling of tiredness? Perhaps the reason is the increased electromagnetic background. Sources of electromagnetic radiation are in every home - these are mobile and landline phones, wi-fi routers, televisions, microwave ovens, electrical wiring.
- **Noise**: The effect of noise is difficult to overestimate. Over time, we cease to perceive noise, but our body reacts to it with disorders of the nervous system and coordination of movements, hearing loss and increased fatigue.

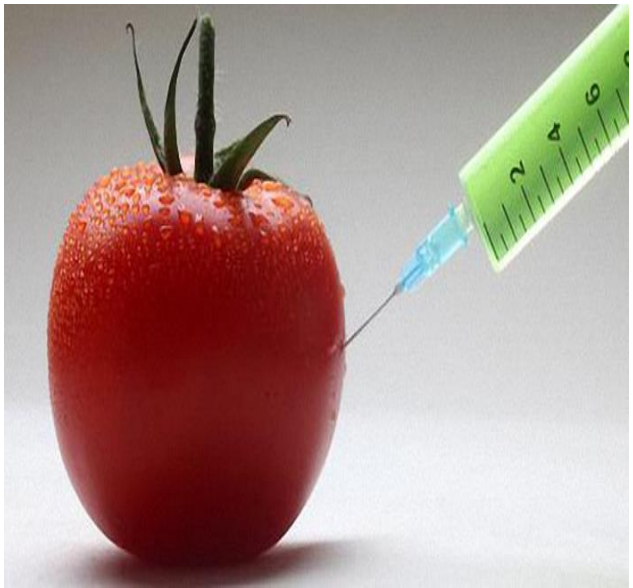
Residential (home) pollution

FOOD ECOLOGY

- Over 90% of human pathologies are associated with the state of the environment. Over 80% of pollutants enter the human body with food. Chemical and biological pollutions are the major factors in reducing product quality.
- Natural toxins polluting food are chemically represented by alkaloids, glucosides and saponins. Mycotoxins are especially dangerous.

GENETICALLY MODIFIED FOODS (biotech food) AND PRESERVATIVES

- Genetically modified foods (GMF) are foods derived from organisms whose genetic material (DNA) has been modified in a way that does not occur naturally, e.g. through the introduction of a gene from a different organism.
- The forces that make us buy genetically modified foods and produce from them most foods for humans and animals tend to quietly destroy us. GMOs are deadly for the biosphere, for our planet and for all civilization ...



GENETICALLY MODIFIED FOODS (biotech food) AND PRESERVATIVES

- Preservatives can be made of "natural" chemicals such as salt or alcohol. They can also be man-made, or synthetic chemicals. "Natural" or "organic" chemicals are not necessarily healthier than synthetic or man-made chemicals. In fact, artificial preservatives such as sodium nitrate, sodium benzoate and propionate have long been used in food preparation because they are effective in small amounts.

GENETICALLY MODIFIED FOODS (biotech food) AND PRESERVATIVES

NAME OF PRESERVAVITES	APPLYING
Sorbic acid, its salts	jams, margarine, mayonnaises, wines, delicacies
Benzoic acid, its salts	canned fruits and vegetables, mayonnaise, pickles
Esters of parahydroxybenzoic acid	canned fish, confectionery
Sulphurous acid	snacks, dried fruits, canned vegetables, wines
Formic acid	smoked fish products, canned food with vinegar
Potassium and sodium nitrites	fish products, cheese

Disease Ecology

- Disease ecology is a sub-discipline of ecology concerned with the mechanisms, patters, and effects of host-pathogen interactions, particularly those of infectious diseases, within the context of environmental factors.

Disease Ecology

- Environmental factors are threats to health, and controlling them is public environmental health. They include:
  - Environmental conditions favoring disease vectors (endemic and exotic vectors);
  - Invasive biota (viruses, bacteria, etc), their hosts and vectors;
  - Environmental disruptions: floods, droughts, storms, fires, earthquakes, volcanoes;
  - Air quality: pollen and pollution leading to respiratory diseases or cancers;
  - Water quality: biotic and abiotic contaminants; integrity of water transport and treatment infrastructure;
  - Monitoring and management of municipal, agricultural, industrial outflows to the environment (gases, liquids, solid wastes).

Disease Ecology

- There are many different types of environmental disease including:

  -Disease caused by physical factors in the environment, such as skin cancer caused by excessive exposure to ultraviolet radiation in sunlight;

  -Disease caused by exposure to toxic or irritant chemicals in the environment such as toxic metals;

  -Lifestyle disease such as cardiovascular disease, diseases caused by substance abuse such as alcoholism, and smoking-related disease.

Influence of environment on inheritance

- Environmental factors play a important role in the occurrence of human hereditary diseases.
- Firstly, salts of heavy metals: these are highly toxic substances that retain their toxic properties for a long time. Heavy metal salts pass through the placenta, which instead of protecting the fetus, poisons it day after day. Often the concentration of harmful substances in the fetus is even higher than that of the mother. Infants are born with malformations of the genitourinary system, up to 25% of babies with abnormalities in the formation of the kidneys.

Influence of environment on inheritance

- Secondly, dioxins, they remain one of the main dangers that threaten present and future generations. Dioxins are found everywhere - in water, air, soil and food.
- Dioxins and dioxin-like substances are invisible but dangerous enemies. These compounds do not decompose in the environment for decades and enter the human body mainly with food, water and air. Dioxin lesions provoke malignant tumors. Transmitted with mother's milk, they lead to such birth defects as anencephaly, "cleft lip". Among the more distant effects of dioxins is the loss of the ability to reproduce offspring.

Influence of environment on inheritance

Influence of environment on inheritance

- In men, impotence and a decrease in the number of spermatozoa are observed, in women - an increased frequency of miscarriages.

Influence of environment on inheritance

- Exposure to dioxins is similar to exposure to radiation. By definition, dioxins play the role of a foreign hormone, suppressing the immune system and enhancing the effects of radiation, allergens, toxins, etc. This provokes the development of oncological diseases, blood diseases and the blood-forming system, endocrine system, and congenital malformations arise.

Influence of environment on inheritance

Influence of environment on inheritance

- Thirdly, pesticides caused considerable harm to the health of people, both participating in their use and not having the slightest relation to it.
- An increase in the frequency of chromosomal abnormalities has been found in people who have suffered acute poisoning with organophosphorus pesticides, as well as among industrial workers who have been exposed to the chronic effects of such pesticides, and among agricultural workers who use them, workers in hexachlorobutadiene production, residents of cotton-growing regions, and workers of greenhouses.

Influence of environment on inheritance

Heredity and Environment Role

- *Heredity* or "Nature"
- Strong Influence on Physical Development.
- Physical Makeup, that a child Inherits from parents.

- *Environment* or "*Nurture*"
- **Everything** that surrounds and influence child.
- *Family, School, Neighbours, Media, etc.*

Save the environment to save life

- Proper handling of waste materials, such as reusing or disposing of them properly, are an important part of our efforts to preserve energy and protect the environment.
- Countries worldwide should use less coal and more reusable power like hydro or solar power.
- Let us plan our cities according to the available water resources and not avail water for too many homes that have been crammed into development. Saving energy reduces air pollution and greenhouse gases. The less we pollute our environment, the more we prevent global warming.
- We can also make simple changes, like using reusable bags and containers. We should try and conserve electricity by turning off the lights, TV, or other electrical appliances when not in use. Use cold water in the washer whenever possible.
- Buy less disposable products. Ban plastic.
- Buy more fuel-efficient cars and recycle your engine oil.
- Use public transit whenever possible. Let us walk more and drive less to conserve fuel and prevent auto-emission.
- We use more organic fertilisers. Our farms need less pesticides and more organic methods.
- Plant trees to improve air quality. Take a stand against deforestation. Losing our rainforests means losing millions of trees that would otherwise be cleaning the air for us.

TAKE CARE OF YOUR HEALTH AND KEEP SAVING THE PLANET