NATIONAL UNIVERSITY OF LIFE AND ENVIROMENTAL SCIENSES OF UKRAINE

Department of General Ecology, Radiobiology and Safety of Life Activity

SOCIAL ECOLOGY

Textbook
for students of Bachelor's Degree in the specialty
101 Ecology

Kyiv - 2023

УДК 504. 75.05 (06)

Rakoid O.O., Klepko A.V., Bondar V.I. Social Ecology. Textbook for students of Bachelor's Degree in the specialty 101 Ecology. – Kyiv: NUBIP, 2023. – 209 p.

Автори:

Ракоїд О.О., доцент кафедри загальної екології, радіобіології та безпеки життєдіяльності НУБіП України, кандидат сільськогосподарських наук;

Клепко А.В., завідувач кафедри загальної екології, радіобіології та безпеки життєдіяльності НУБіП України, доктор біологічних наук;

Бондарь В.І., доцент кафедри загальної екології, радіобіології та безпеки життєдіяльності НУБіП України, кандидат сільськогосподарських наук; с.н.с.

Рецензенти:

Андрейченко С.В., завідувач кафедри екології та ландшафтного дизайну ПВНЗ «Європейський університет», доктор біологічних наук, професор;

Чоботько Г.М., провідний науковий співробітник відділу радіоекології і дистанційного зондування ландшафтів Інституту агроекології і природокористування НААН, доктор біологічних наук, професор;

Боголюбов В.М., професор кафедри загальної екології, радіобіології та безпеки життєдіяльності НУБіП України, доктор педагогічних наук, професор;

Клименко Л.В., старший викладач кафедри англійської філології НУБіП України.

Рекомендовано до видання Вченою радою Національного університету біоресурсів і природокористування України (протокол № 3 від 27 вересня 2023 р.)

У навчальному посібнику для студентів ОС Бакалавр за спеціальністю 101 Екологія вперше англійською мовою ґрунтовно викладені теоретичні і практичні аспекти соціальної екології; у тому числі, значна увага приділена історії становлення науки та її місцю у системі сучасних екологічних знань, специфічним зв'язкам між суспільством, природою, людиною та її життєвим середовищем у контексті глобальних та регіональних проблем людства з метою не тільки збереження, а й удосконалення середовища людини як природної та суспільної істоти.

LIST OF CONTENT

INTRODUCTION

The development of contemporary scientific knowledge is determined by the integration of approaches and disciplines. Social ecology is a sphere of sociological knowledge that integrates natural science and humanitarian disciplines.

Besides enhancing the cognitive potential of transdisciplinary research, it also allows us to move beyond the usual social relationships of "individual-individual", "individual-social group" and "individual-social institution". New forms of relationships are emerging and being studied in society: "personality-environment", "social group-environment", "social institution-environment", "society-environment". It is precisely the analysis of the latter that is the object of study of social ecology.

Social ecology, a discipline emerging at the intersection of the natural, technical, and human sciences, considers various scenarios for the development of the relationship between humans and the biosphere.

The key objective of social ecology is to improve the coexistence of human beings and the natural environment on a systematic basis. The aim of this course is to present a holistic view on social ecology, which studies the spatial and temporal characteristics of the interaction between society and nature.

The purpose of this textbook, developed for undergraduate students in 101 Ecology, is to provide bachelors with a fundamental understanding of the general problems of human civilisation and the variety of activities in the field of nature management.

The environmental education system should form an ecologically oriented person capable of applying knowledge, skills and abilities, as well as their personal qualities to solve the tasks of professional activity, social involvement and achieving personal success within the framework of sustainable development.

The main objectives of the discipline are:

- to form students' ideas about the conceptual origins and historical prerequisites for the formation of social ecology; about the integrated nature of social-ecological knowledge, about the question of the relationship between humans, society and nature over the entire history of humanity;

- to explore ways of optimising the existence of humans and the environment at the system level;

- to show the relationship between the level of anthropogenic load and the population's quality of life;

- to provide an understanding of the moral aspects of the attitude of society to the environment, the principles of ecological culture and ecological education of citizens.

Mastering the course, including the performance of independent tasks, will enable students to form professional skills and competences required for further work, such as: skills of searching and structuring information, analysis of subsidiary sociological research, establishment of cause-and-effect relationships, trends and controversies, and mastering the methods of the socio-environmental research and their appropriate application to the set tasks and goals.

Authors: National University of Life and Environmental Sciences of Ukraine: ***Rakoid O.O.***, PhD in Agriculture, Associate Professor (Introduction; Sections 1, 2, 4, 5, 7), ***Klepko A.V.***, Doctor of Biology, Head of department (Sections 3, 6, Glossary), ***Bondar V.I.***, PhD in Agriculture, Associate Professor (Sections 8, 9).

Section 1.

SOCIAL ECOLOGY: SUBJECT, METHODS, PRINCIPLES AND LAWS

In English literature term “Social ecology” has many definitions. It is used as a synonym for ***human ecology***, especially in sociology (has its origins in the Chicago School of Sociology in the 1920s); it is considered one form of ecological psychology; and it is the name chosen for the mix of approaches taught at the University of California, Irvine, as well as the radical revisionism of Murray Bookchin.

For example, the Program in Social Ecology at the University of California, Irvine has been defined by Arnold Binder (one of conceptual authors, 1970) as “a new context for psychology,” but it includes major subprograms in community psychology, urban and regional planning, environmental health, human ecology, criminal justice, and educational policy.

He concluded by defining social ecology as the study of “the interaction of man with his environment in all of its ramifications.” In a later article, Binder and others divided the ecological psychology into an ecological approach, an environmental approach, and social ecology itself, which they then enlarged into “a new departure in environmental studies” at Irvine.

For Green author and activist Murray Bookchin social ecology envisions a moral economy that moves beyond scarcity and hierarchy, toward a world that reharmonizes human communities with the natural world, while celebrating diversity, creativity and freedom. Social ecology, according to Bookchin, suggests that the roots of current ecological and social problems can be traced to hierarchical modes of social organization.

Bookchin established an Institute for Social Ecology in Plainfield, Vermont, which organizes conferences and publishes a journal. His philosophical theory of social ecology is often considered to be a form of eco-anarchism.

In Germany, social ecology was mainly developed by Institute for Social-Ecological Research (ISOE), which developed this transdisciplinary field of science in terms of their research program. Since 1980th, the institute has been focused on the most pressing concerns that society is currently facing such as water shortages, energy consumption, mobility concerns and the loss of biodiversity.

1.1 The emergence of social ecology as a science. Key milestones in the development of science

The term "social ecology" owes its appearance to American researchers, representatives of the Chicago school of social psychologists Robert Park and Ernest Burgess. The authors used it as a synonym for the concept of "human ecology". They first introduced this term in 1921 in their work on the theory of the population's behavior in an urban environment titled *An Introduction to the Science of Sociology*.

a)

b)

Figure 1.1. Founders of social ecology a) Robert Ezra Park; b) Ernest Burgess

They drew heavily on the work of biologists such as C.R. Darwin, F.F. Clements and C.S. Elton.

This publication became a landmark for many other contributions that studied the spatial distribution of human populations, especially in urban areas.

In addition, the application of concepts borrowed from plant and animal ecology for the study of human communities implied that human ecology was interpreted as the study of those biotic factors that influence the social organization and spatial distribution of human groups and communities.

Park and Burgess defined human ecology as the study of the spatial and temporal organization and relations of human beings with respect to the "selective, distributive and accommodative forces of the environment".

Park himself explains human ecology as, "fundamentally an attempt to investigate the processes by which the biotic balance and social equilibrium are disturbed, the transition is made from one relatively stable order to other".

The prominent American sociologist Emory S. Bogardus acknowledges that Park is the father of human ecology, proclaiming, "Not only did he coin the name but he laid out the patterns, offered the earliest exhibit of ecological concepts, defined the major ecological processes and stimulated more advanced students to cultivate the fields of research in ecology than most other sociologists combined".

In a 1936 in article entitled *Human Ecology*, Robert Park elaborated the classical position of human ecology. Park's work had a biological base with sociological applications.

The central organizing concept is competition, a restatement of Darwin's idea of "the struggle for existence". For Park, human society was organized on two levels, the biotic, based on competitive cooperation, and the cultural, based on communication and consensus. The biotic level influenced human adjustments and spatial distributions of populations. Human ecology studied the processes that maintained and changed the biotic balance and social equilibrium.

R.D. McKenzie broadened the scope of human ecology to be even more distinctly sociological. For McKenzie, human ecology was concerned with the spatial grouping and sustenance relations of humans occupying a geographical area. The interaction of humans around space and sustenance resulted in sociological

changes in the population, such as mobility, employment, segregation, and dispersion. (“The Scope of Human Ecology”, 1926)

Other social science disciplines also adopted the ecological perspective. For example, early papers with a human ecological perspective were published in geography, anthropology, and psychology. More recently the social science literature has included the human ecological perspective in economics, political science, cultural anthropology and environmental psychology.

By the late 1930s human ecology was being criticized.

It is perhaps ironical that the first attempt to produce a general outline of human ecological theory, Milla Alihan’s “*Social Ecology: A critical analysis*” was also a most incisive critical analysis of the subject.

Alihan’s book, which appeared in 1938, is an attempt to piece together a consistent theory of human ecology from the varied and scattered writings on the subject, while at the same time showing the contradictions and logical inconsistencies which resulted from such an attempt.

Amos H. Hawley in his article “Ecology and Human Ecology” (1944) suggests the following:

“Probably few will deny, however, the problem with which study is to be concerned must not only be significant but must also be a problem that is not already preempted by other disciplines. It is no easier to defend a needless duplication of effort than it is a preoccupation with irrelevant issues. Unless human ecology has a problem of its own, then, it is nothing and may well be forgotten”.

Perhaps Hawley's 1944 assessment was correct. And, indeed, it was not until the 1960s when population, resource, and environmental problems became dominant and not preempted by other disciplines that human ecology became an important area of study.

It one person and publication were used to identify the recent significance of human ecology. It would have to be Rachel Carson’s *Silent Spring*, published in 1962.

Figure 1.2. Rachel Carson, a marine biologist and nature writer

Simply, clearly, and forcefully written, it carried the message that the use of chemicals, particularly chlorinated hydrocarbons, had grave consequences. Chapters provide the scientific background and examples of chemical effects on soil, on plants, to birds and fish, and on humans.

In the opening paragraph of Silent Spring, Rachel Carson provides the human ecology context. “The history of life on earth has been a history of interaction between living things and their surroundings. To a large extent, the physical form and the habits of the earth’s vegetation and its animal life have been molded by the environment.

Considering the whole span of earthly time, the opposite effect, in which life actually modifies its surroundings, has been relatively slight. Only within the moment of time represented by the present century has one species−man−acquired significant power to alter the nature of his world”.

The message of Silent Spring was hotly debated. Environmental problems came to the public s attention, and a human ecological perspective was presented.

The *Population Bomb*, written in 1968 by Paul Ehrlich, is another significant book in the recent development of human ecology. This book demonstrated how

population growth was related to numerous other problems such as food shortages, environmental degradation, and economic growth.

Garrett Hardin's 1968 essay, *The Tragedy of the Commons*, is a classic statement in human ecology. This article continues to be insightful and informative about the relationship among populations, the physical environment, and cultural issues related to carrying capacity.

The list of significant contributors to human ecology has to include Barry Commoner. His most notable contribution was *The Closing Circle* published in 1971 where Commoner directed his attention to the environmental crisis and confronted the interrelationship of humans and the environment.

Ten years after Silent Spring, a Club of Rome report entitled *The Limits to Growth* (1972) was published and the fundamental findings of this study remain significant in the development of human ecology.

In particular the conclusion stated: "It the present growth trends in world population, industrialization, pollution, food production and resource depletion continue unchanged, the limits to growth on this planet will be reached sometime within the next one hundred years. The most probable result will be a rather sudden and uncontrollable decline in both population and industrial capacity.

It is possible to alter these growth trends and to establish a condition of ecological and economic stability that is sustainable far into the future. The state of global equilibrium could be designed so that the basic material needs of each person on earth are satisfied and each person has an equal opportunity to realize his individual human potential".

The noted ecologist Eugene Odum has suggested that ecology may emerge as a new integrative discipline.

He summarizes: "The new ecology, then, is not an interdiscipline, but a new integrative discipline that deals with the supraindividual levels of organization, an arena that is little touched by other disciplines as currently bounded − that is, by disciplines with boundaries established and strongly reinforced by professional

societies and departments or curriculums of universities. Among academic subjects, ecology stands out as being one of the few dedicated to holism". (1977)

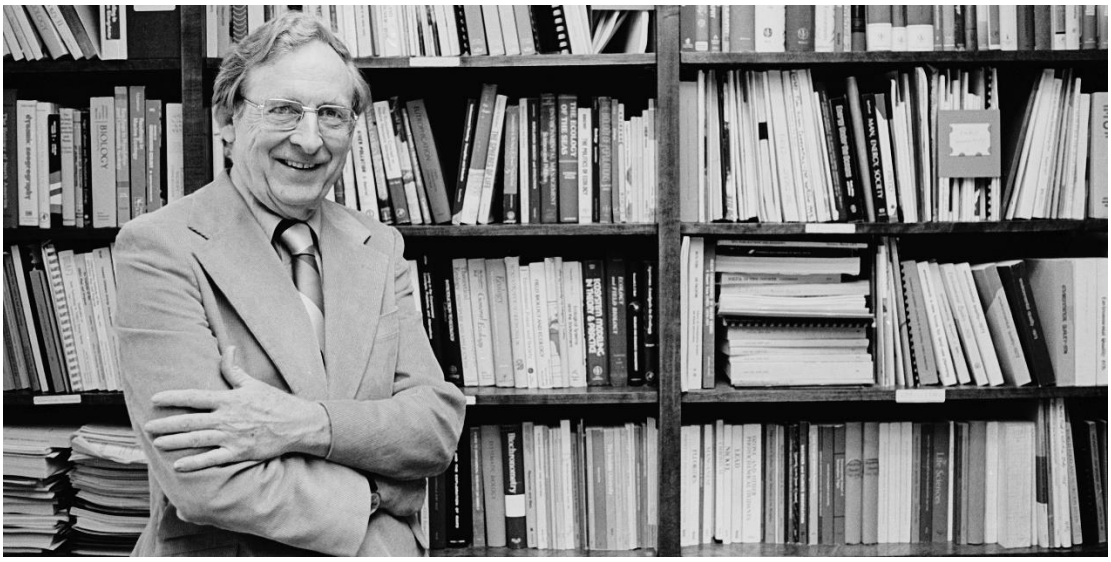


Figure 1.3. Eugene Odum, called "the father of modern ecology"

Odum stresses the ecosystem level of study and uses a holistic methodology. Humans are as much a part of the integrative approach as other organisms. In fact, Odum points out that the new ecology links the natural and social sciences.

1.2 The modern concept of social ecology

Social ecology today is, in the most basic terms, conceived as a scholarly approach, which starts off with the idea of separated material and constructed systems or dimensions and certain forms of transactions that mediate between the two.

On the epistemological level, this approach comes with a strong emphasis on the need to integrate scientific disciplines, theories and methods. In fact, the term "social ecology" was suggested by Milla A. Alihan (*Social Ecology: A Critical Analysis, 1938*) as the name of **an analytical framework for studies of the relations between humans and their environments**, which was intended to be

more integrative than the field of human ecology as put forward by the Chicago School in the 1920s.

Social ecology is a scientific discipline that empirically explores and theoretically summarizes the specific relationships between society, nature, human beings and their living environment in the context of global and regional problems of humanity with the goal of not only maintaining but also improving human environment as a natural and social being.

In contrast to general ecology, “social ecology” usually refers to the study of the dynamic interrelationships between human populations and the physical, biotic, cultural, and social characteristics of their environment and the biosphere.

Understanding of social ecology can be multifaceted. From the point of view of N.F. Reimers, the division of these disciplines (human ecology and social ecology) is possible based on the dualistic quality of human being himself:

- when it comes to the individual, the reproductive group − it is ***human ecology***;
- when considering the social series, personality, family − it is ***social ecology***;
- unification of scientific branches that study the relationship of the individual, family and other social groups with nature and the social environment − it is the ***synecology of human***;
- the relationship between “nature and human society” on a global scale is studied by the ***global human ecology***.

Social ecology is not limited to the study of environmental issues, the preservation of optimal parameters of natural, cultural, man-made environments, and appears as a synthesis of knowledge about human and everything around him, their relationships and interactions, enriches other fields of knowledge and human activity with anthropogenic principles.

Social ecology examines the relationships between society and nature and poses the question of how these relationships can be made more sustainable.

1.3 Subject and methods of research

The **object** of social ecology is the socioecosystem, the relationship of the population of biosocial beings − humanity − with the environment.

The **subject** of social ecology is the laws of interaction between society and nature, mechanisms to reduce environmental pollution, maintaining ecological balance, as well as legal and socio-cultural conditions for sustainable development.

The **goal** of social ecology is to optimize the joint development (co-evolution) of society and nature by changing the system of human values, interests and needs.

Every science uses both general and special methods in its research. Method (from the Greek word “tracing”, “way of research”) is a way of constructing and justifying of knowledge. From a scientific point of view method is a way to achieve new results and scientific truths.

Social ecology is a relatively young science; its method is not completely formed. It uses the methods of natural and social sciences. The method of social ecology is determined by the objective laws that constitute the essence of its subject matter.

On this basis, social ecology has developed a general approach to solving a number of theoretical problems. These may include such problems as a systemic understanding of the world; the ecological crisis; the crisis of human existence in the modern world; profit-oriented industrialism as the cause of the ecological crisis; overcoming the ecological crisis as a prerequisite for civilized development; the globality of ecological problems; universal responsibility for their solution.

There are three main groups of methods in the methodological apparatus of social ecology: informational, mathematical, and normative and technological.

Information methods are divided into sociological and biospherical methods.

Mathematical methods are based on the results of informational research and build predictive models of the relationship between human and nature.

Normative-technological methods are designed to change the technological basis of human activity and to develop new principles of the relationship of the human community to the natural environment.

1.4 Principles and laws of social ecology

Social ecology incorporates a number of scientific principles and laws derived from the natural sciences and formulated by ecologists V.I. Vernadsky, N.F. Reimers, and B. Kommoner.

Principles of Social Ecology:

- human society, like any population, cannot grow indefinitely;
- society in its development must take into account the measure of phenomena occurring in the biosphere;
- sustainable development of society depends on a timely transition to alternative resources and technologies;
- any transformative activity of society must be based on an ecological forecast, which takes into account as many factors as possible;
- the development of nature should not diminish the biodiversity of the planet and degrade the quality of human life;
- the sustainable development of civilization depends on the moral qualities of people;
- everyone is responsible for their actions to future generations;
- we have to think globally, but act locally;
- the unity of nature obligates humanity to cooperation, not parasitism.

Social ecology makes sense of socio-natural laws.

Their distinctive feature is that they are designed to define the necessary conditions for the sustainable development of social ecosystems at various levels. And these conditions should govern the focus of human activity within the biosphere.

N.F. Reimers formulated **five laws of social ecology**:

1. The rule of social-ecological balance. This law indicates that society progresses when and as long as there is a balance between its "pressure" on the environment and the possibility of restoring this environment by natural or artificial means.

2. The principle of cultural management of development. The second law indicates that economic development is limited by the ecological framework and points to the necessity of managing development by taking into account the profound processes of interaction that take place between society, nature, the individual, and the social groups in which the individual lives.

3. The rule of socio-environmental substitution. This rule contains the idea of the importance of understanding the possible changes in human socio-ecological needs in different ways, which are caused by specific characteristics of the natural environment and that influence on it.

4. The law of historical (socio-ecological) irreversibility. This law contains the idea of historical irreversibility, i.e., that the development of society is carried out through certain phases and their order cannot be disturbed.

5. Vernadsky's law of the noosphere. It is this law states that the biosphere is inevitably transitioning to the noosphere, that is, to a sphere where the human mind plays a dominant role in the development of the "human-nature" system.

In 1974, American biologist Barry Commoner, after summarizing the provisions of bioecology and social ecology, stated **four basic laws of ecology**:

1. Everything is Connected to Everything Else. There is one ecosphere for all living organisms and what affects one, affects all.

In the written works, the scientist tried to convey the idea that in the surrounding world all components are connected with each other. If humanity spoils something in one place of the biosphere, then this certainly affects others. Any impact, even small, entails the consequences, including negative.

This principle illustrates a huge number of connections between the ecosystem of living beings and the environment, biosphere and society, and components of multiple systems.

Figure 1.4. Barry Commoner, American biologist and educator

In his work, Commoner relied on the scientific works of his predecessors. In one of the works to illustrate the first principle, he outlined the story of Charles Darwin. Once the rural residents came to Darwin for the Council. They asked the scientist to prompt them how to raise the yield of buckwheat cereals. To which the scientist advised to start more cats: they destroy the rodents who eat a barbell, as a result of which the yield of the latter will increase.

2. Everything Must Go Somewhere. There is no “waste” in nature and there is no “away” to which things can be thrown.

It follows from the fundamental law of conservation of matter. In nature, only those substances that may subsequently be destroyed naturally are synthesized. In accordance with the first principle, all pollution will return to a person back. This allows you to prepare the problem of waste material industry in a new way. Synthesizing humanity of new substances that cannot be destroyed without harm to

the environment, led to the problem of waste accumulation, where they should not be. The same applies to the production of fossil: recycled oil leads to pollution and deterioration of the environmental situation.

The second law is based on the principle of redistribution of domestic garbage and waste-free environmental production. When creating new technologies, it is worth considering that they are less resource-proof, and also used processing products. In addition, it is necessary to apply the most gentle method of utilization of garbage.

3. Nature Knows Best. Humankind has fashioned technology to improve upon nature, but such change in a natural system is, says Commoner, “likely to be detrimental to that system.”

The third principle is based on the theory of evolution. The existing organisms and combinations in the modern world are the result of a long process of evolution and natural selection. Of the huge number of substances, as a result of the selection process, there were those compounds that are most acceptable to earthly conditions and have decomposing their enzymes. Nature through a competitive struggle for existence, only the strongest organisms are resistant to specific climatic conditions.

Active transformations of a man of an natural environment, biogeocenoses, as well as extermination of plants and animals can lead to irreversible consequences, as a result of which the world will cease to be suitable for the existence of humanity. Without the accurate knowledge of the functioning of the laws of ecosystems and biocenoses and the consequences of their change impossible, no "improvements" of nature is impossible.

Human abandoned intervention in order to solve problems can lead to even greater damage. The mass shot of the sparrows in Asia, appreciating, in the opinion of residents, harming crops, served as the insects occupied their place. Last having lost their natural enemies increased their population and caused more harm to sow. Changes in the ecological circuit led to a greater reduction in yield.

4. There Is No Such Thing as a Free Lunch. Nothing comes from nothing. Exploitation of nature will inevitably involve the conversion of resources from useful to useless forms.

This law combines three previous ones. The biosphere, as a comprehensive ecosystem, is one. The victory in one place is accompanied by a defeat in the other.

Saving funds to protect the environment turns into a person complicating health, natural catastrophes and a decrease in favorable conditions for life. All that was obtained from it as a result of human labor, ultimately should be refunded.

The teachings of Commoner's laws of ecology are acceptance of the balance and interdependence of nature. These laws should be accounted for in environmental management and in general in all human activities on Earth and in the Cosmos.

Self-control questions to Topic 1:

1. The term “social ecology” owes its appearance to:

a) American scientist Harlan Burroughs;

b) American researchers Robert Park and Ernest Burgess;

c) American marine biologist Rachel Carson;

d) Ukrainian naturalist Volodymyr Vernadsky.

2. What publication drew the public's attention to the environmental problems?

3. Significant contributors to human ecology and their books:

1. Garrett Hardin	*A. The Population Bomb*
2. Barry Commoner	*B. Silent Spring*
3. Rachel Carson	*C. The Tragedy of the Commons*
4. Paul Ehrlich	*D. The Closing Circle*

4. The scientist who stresses the ecosystem level of modern ecological study and uses a holistic methodology was Barry Commoner (yes or no).

5. Eugene Odum points out that the new ecology links the … and … sciences (fill in the gaps with the correct words).

6. Give the definition of social ecology as a science.

7. The object of social ecology is:

a) system "human - environment" or socioecosystem;

b) human;

c) environment;

d) economy.

8. What is the goal of social ecology?

9. Methods of what sciences does social ecology use?

10. Three main groups of methods in the methodological apparatus of social ecology:

1. Information methods	*A. are designed to change the technological basis of human activity and to develop new principles of the relationship of the human community to the natural environment*
2. Mathematical methods	*B. are divided into sociological and biospherical methods*
3. Normative-technological methods	*C. are based on the results of informational research and build predictive models of the relationship between human and nature*

11. One of the principles of social ecology is "we have to think globally, but act locally", isn't it?

12. What states Vernadsky's law of the noosphere? Express the main idea of this law.

Section 2.
SOCIO-ECOLOGICAL INTERACTION AND ITS SUBJECTS

2.1 The concept of the human environment and its main elements

Social ecology links the environment and human activity into a single system of Nature-Society. If the subject of social ecology is the processes in socio-ecosystems, i.e., the study of specific connections both within these systems and between humans and their living environment, then there is a need to define the concept of "human environment".

The famous Serbian ecologist Danilo Markovich provides the following definition of the human environment: "The living environment includes the complex of physical, chemical and biological entities, as well as social factors that can affect directly or indirectly, immediately or in the long term, all living beings and human activities."

The definition of the human environment can be found in UN documents. Thus, the Introduction to the Declaration of the United Nations Conference on the Human Environment, or Stockholm Declaration (1972) states that:

"Man is both creature and moulder of his environment, which gives him physical sustenance and affords him the opportunity for intellectual, moral, social and spiritual growth. In the long and tortuous evolution of the human race on this planet a stage has been reached when, through the rapid acceleration of science and technology, man has acquired the power to transform his environment in countless ways and on an unprecedented scale. Both aspects of man's environment, the natural and the man-made, are essential to his well-being and to the enjoyment of basic human rights - even the right to life itself."

Thus, what is Human Environment? Human environment shall be interpreted comprehensively to include the natural and physical environment and the relationship of people with that environment. The state of the earth's environment

dictates the existence, safety, and health conditions of human and is affected by the interactions between human and the natural environment.

The most general notion of human environment can be defined as the set of natural and artificial conditions in which man realizes himself as a natural and social being.

The human environment consists of two interrelated parts: natural and social (Fig. 2.1.). The natural component of the environment makes up the total space directly or indirectly available to humans. This is first of all the planet Earth with its diverse envelopes.

The social part of the human environment consists of society and social relations, thanks to which a man realizes himself as a social active being.

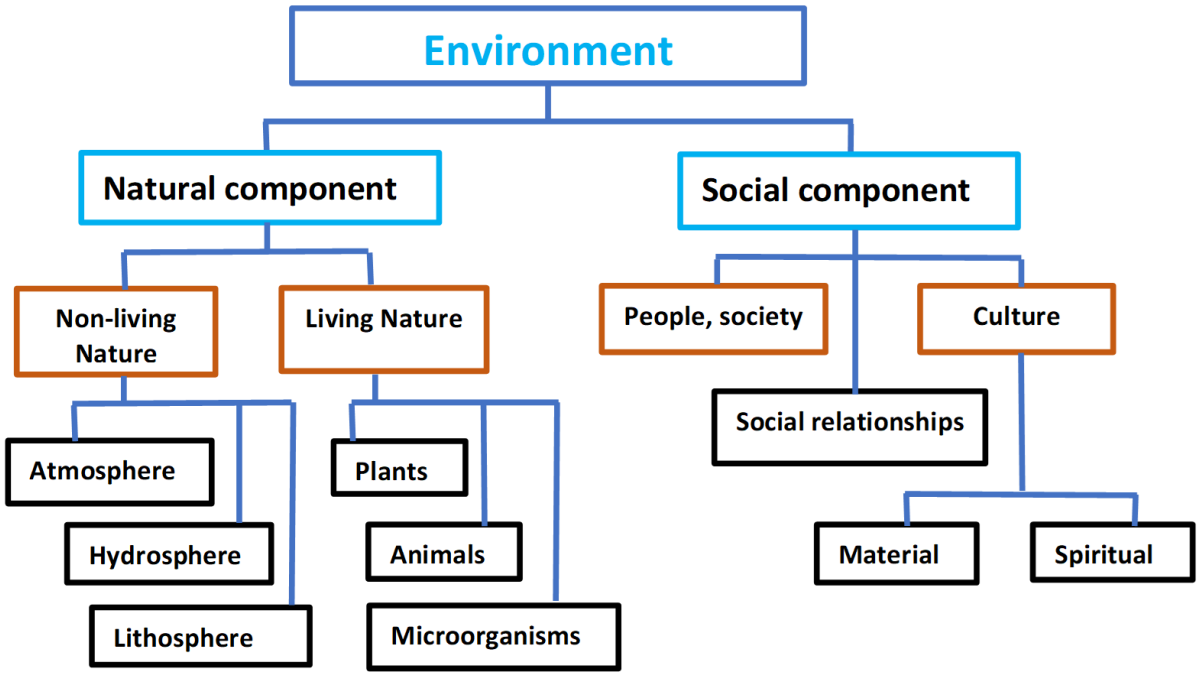


Figure 2.1. Components of the environment of human and society (by D. Zh. Markovich)

As elements of the natural environment (in its narrow sense) D. Markovich considered the atmosphere, hydrosphere, lithosphere, plants, animals and

microorganisms. All of these elements are part of the ecosystems surrounding humans, and the cycle of matter in the biosphere makes living nature possible, as the Earth has a closed ecological system (excluding energy inputs).

Atmosphere. It is the gaseous envelope surrounding the earth and extends up to 500 kms above the earth's surface. The composition of the atmosphere is given in Table 2.1.

Table 2.1. The composition of the atmosphere

Constituent	Volume %
Nitrogen	78.1
Oxygen	20.9
Water vapour	0.1–5
Argon	0.9
Carbon dioxide	0.03
Trace constituents*	Balance

**The trace constituents include Helium, Neon, Krypton, xenon, SO_2, NO_2, Ammonia, Ozone, and Carbon monoxide etc.*

The atmosphere protects the earth from cosmic radiations and provides life sustaining Oxygen, the macronutrient Nitrogen and Carbon dioxide needed for photosynthesis. The atmosphere screens the dangerous UV (ultraviolet) radiations from the sun and allows only radiations in the range of 300 nm – 2500 nm (near UV to near IR Infrared) and radio waves.

The atmosphere plays a major role in maintaining the heat balance of the earth by absorbing there-emitted radiation from the earth. In addition, the atmosphere is the medium of carriage of water from the oceans to the land in the hydrological cycle.

The atmosphere is broadly divided into four major zones viz. Troposphere, Stratosphere, Mesosphere and Thermosphere. Characteristics of these zones are pictorially represented in Fig. 2.2.

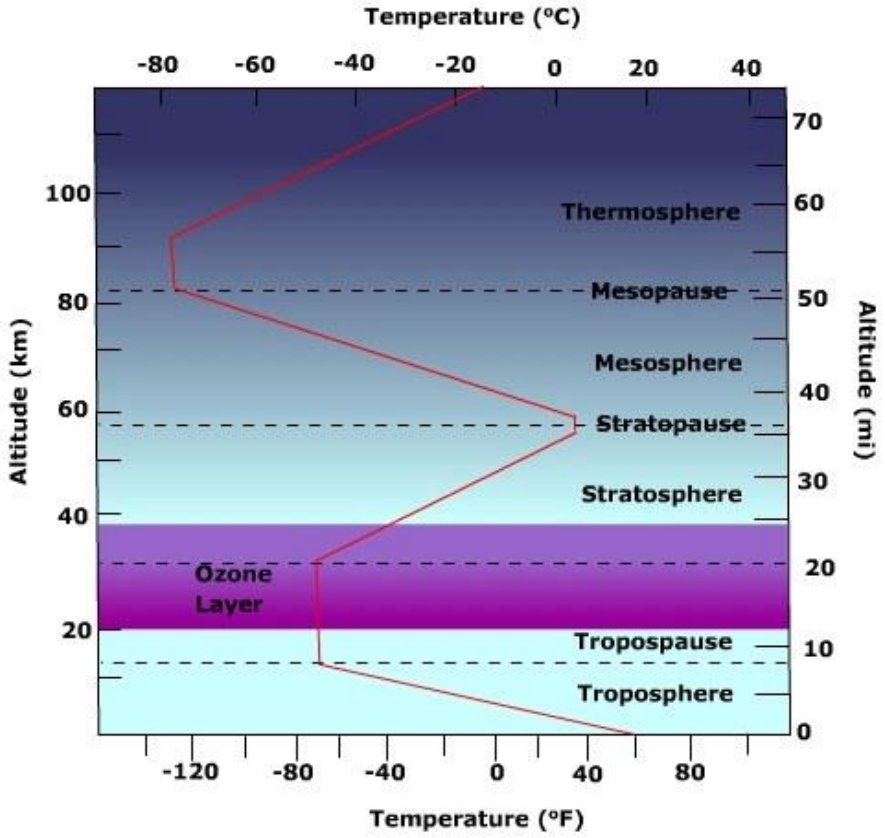


Figure 2.2. The various layers of the atmosphere showing the temperature changes

The troposphere which is the inner layer of the atmosphere extends up to 17 Km (11 miles) above the mean sea level. This contains most of the planet's air (nearly 80 to 85 %).

The composition of tropospheric air is: nitrogen (78%), oxygen (20.94%), carbon dioxide (0.03%), Argon (0.93 %) and many other trace gases. It shows a decrease in temperature with an increase in altitude at a rate of 6.50 C per kilometer.

The atmospheric pressure also reduces with an increase in altitude due to reduction in the weight of overlying air. When one climbs up the mountains one can feel this effect.

Tropopause separates the troposphere from stratosphere which is the next higher layer extending from 17 to 48 km.

Ozone present in the lower layer of the stratosphere forms distinct ozonosphere that protects the earth from the harmful UV radiations of the sun. This absorption of UV radiation results in an increase in stratospheric temperature.

Above the stratosphere is mesosphere up to an altitude of 80 to 90 Km. There is a decrease in temperature in this layer of the atmosphere. It burns the meteors entering the earth's surface by the collision with the gas particles. This causes an increase in the concentration of its iron and other metals in this layer.

Mesosphere along with the stratosphere makes the middle layer of the atmosphere. Beyond the mesosphere is thermosphere which extends up to 500–600 km above the surface of the earth. The increase in temperature in this layer is due to the absorption of solar radiations. The temperature in it may rise as high as 17270 C. It consists of very little of light gases such as oxygen, helium and hydrogen in their atomic form.

Exosphere is beyond thermosphere and it merges with interplanetary gases or space. Exosphere contains mainly helium and hydrogen at very low density.

Hydrosphere The hydrosphere is a collective term given to all different forms of water. It ranges from 10 to 20 kilometers in thickness.

This comprises all water resources both surface and ground water. The world's water is found in oceans and seas, lakes and reservoirs, rivers and streams, glaciers and snowcaps in the Polar Regions in addition to ground water below the land areas.

The distribution of water among these resources is follow:

− Oceans and seas: 96–97 %;

− Glaciers and polar ice caps: 2–3 %;

− Fresh water: < 1%.

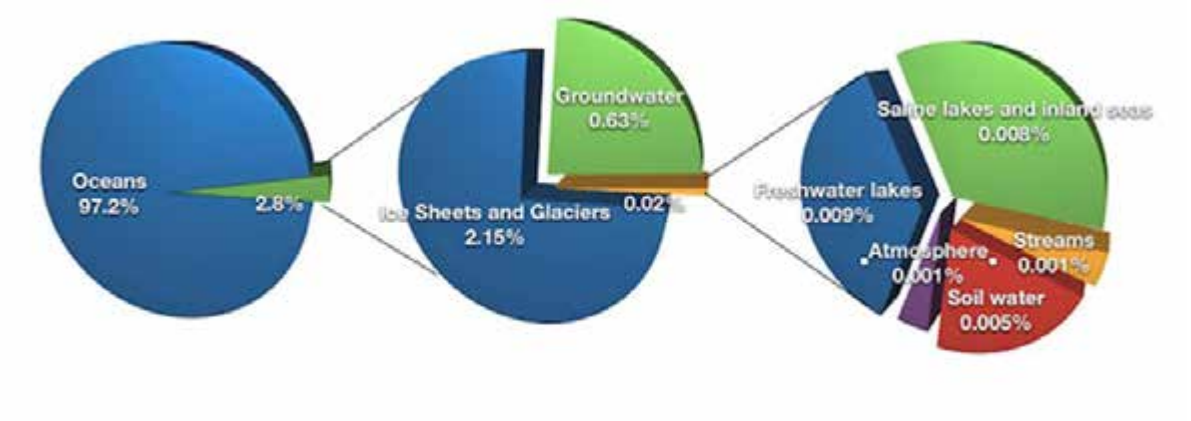


Figure 2.3. Various stores of water in the hydrosphere

The water, locked up in the Oceans and Seas, are too salty and cannot be used directly for human consumption, domestic, agriculture or industrial purposes. Only less than 1% of water resources are available for human exploitation.

Water is considered to be a common compound with uncommon properties. These uncommon properties (e.g., anomalous expansion of water) are mainly responsible for supporting terrestrial and aquatic life on earth.

Lithosphere The lithosphere contains all of the cold, hard solid land of the planet's crust (surface), the semi-solid land underneath the crust, and the liquid land near the center of the planet.

The surface of the lithosphere is very uneven. There are high mountain ranges, huge plains or flat areas, and deep valleys along the ocean floor.

The solid, semi-solid, and liquid land of the lithosphere form layers that are physically and chemically different.

The outermost layer of the lithosphere (the earth's crust) consists of the soil and rocks. The soil is made up of inorganic and organic matter and water.

The main mineral constituents are compounds or mixtures derived from the elements of Si (Silicon), Ca (Calcium), K (Potassium), Al (Aluminum), Fe (Iron), Mn (Manganese), Ti (Titanium), O (Oxygen) etc. (Oxides, Silicates, and Carbonates).

The organic constituents are mainly polysaccharides, organo-compounds of N, P (Phosphorus) and S (Sulfur). The organic constituents even though form only around 4% – 6% of the earth's crust, they are responsible for the fertility of the soil and hence its productivity.

Next is a thick, semi-solid mantle of oxygen, silicon, iron, and magnesium. Below that is a liquid outer core of nickel and iron.

At the center of Earth is a solid inner core of nickel and iron. The word "lithosphere" can take on different meanings depending on the speaker and the audience. For example, many geologists – scientists who study the geologic formations of Earth reserve the word "lithosphere" to mean only the cold, hard surface of Earth, not the entire inside of the planet.

The biosphere contains all the planet's living things. This sphere includes all of the microorganisms, plants, and animals of Earth.

Within the biosphere, living things form ecological communities based on the physical surroundings of an area. These communities are referred to as biomes. Deserts, grasslands, and tropical rainforests are three of the many types of biomes that exist within the biosphere. It is impossible to detect from space each individual organism within the biosphere. However, biomes can be seen from space. For example, the image distinguishes between lands covered with plants and those that are not. Some scientists place humans in their own sphere called the "anthroposphere."

All these physical and biological factors working in tandem with cultural, social, economic and other man-made elements provide a suitable environment for sustenance of all life-forms. The manner in which they interact with each other plays a crucial role in maintaining an ecological balance.

A somewhat different approach to the analysis of the structure of the human environment was proposed by N.F. Reimers.

He distinguished four inextricably interconnected components-subsystems in the human environment: a) natural environment, b) environment generated by

agricultural technology - the so-called “second nature”, or quasi nature, c) artificial environment - "third nature", or arte-nature, and d) social environment (Fig. 2.4.).

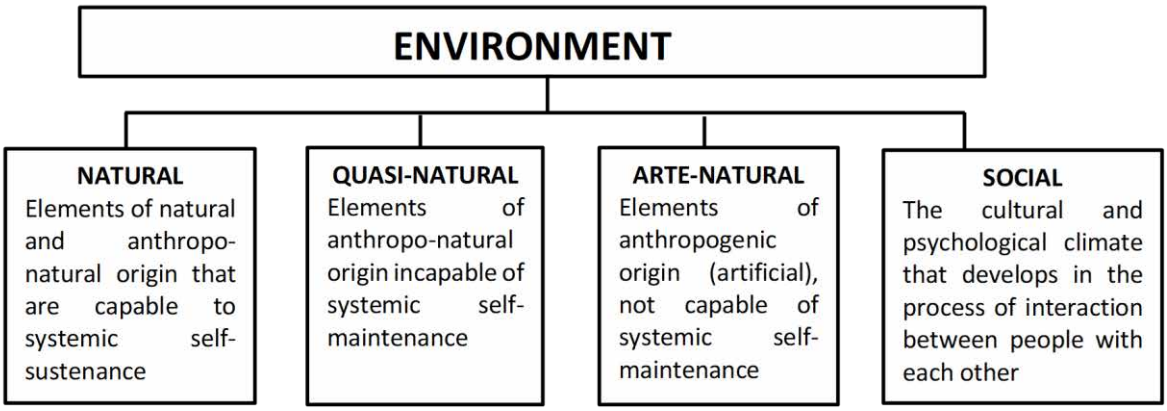


Figure 2.4. Components of the human environment (by N.F. Reimers)

The natural environment surrounding an individual is a factor of either natural or natural-anthropogenic systemic origin, i.e. those that have the properties of self-support and self-regulation without constant corrective action by humans. These factors directly or indirectly, consciously or unconsciously, affect individuals or groups. These factors include:

- energy state of the environment (thermal and wave, including magnetic and gravitational fields);

- the chemical and dynamic nature of the atmosphere;

- water component (humidity of the air, earth's surface, chemical composition of water, its physics, its very presence and correlation with the inhabited land);

- physical, chemical and mechanical character of the land surface (including geomorphological structures - flatness, hills, mountains, etc.);

- the type and composition of the biological part of ecological systems (vegetation, animal and microbial population) and their landscape combinations (including combinations of non-agricultural and forestry lands with natural ecosystems);

- the degree of balancedness and stationarity of the components that create climatic and landscape conditions and ensure a certain rhythm of natural phenomena, including natural disasters and other events that are considered as disasters (earthquakes, floods, hurricanes, natural focal diseases, etc.);

- population density and human interaction as a biological factor;

- the information component of all these phenomena.

The "second nature" environment, or quasi-natural environment, is all modifications of the natural environment that are artificially transformed by humans and are characterised by the lack of systemic self-support (i.e., they gradually collapse without constant regulatory influence from humans). These include:

- arable and other human-transformed land ("cultural landscapes");

- unpaved roads;

- the external space of settlements with its natural physical and chemical characteristics and internal structure (demarcation by fences, various buildings that change thermal and air regimes, green belts, ponds, etc.);

- green spaces (lawns, boulevards, gardens, landscape parks and forest parks that imitate the natural environment).

All of these formations are of natural origin, represent a modified natural environment and are not purely artificial, i.e., they do not exist in nature (houses are seen as a whole, similar to rocks, energy as only a transformed natural flow of solar heat, and so on). Probably, domestic animals, including pets, should also be included in the "second nature". The same applies to cultivated plants.

The "third nature" or artificial environment is the entire artificial world created by humans, which has no analogues in nature, is systematically far from it, and which, without continuous restoration, immediately begins to deteriorate.

It is a substance that has already been completely transformed by humans and is either not included in natural geochemical cycles or is difficult to enter them. The "third nature" includes the asphalt and concrete of modern cities, the interior space of residential and workplaces, transport and service enterprises (physical and

chemical characteristics, dimension, aesthetics of the premises, etc.); technological equipment; transport facilities; furniture and all synthetics.

Modern man is mainly surrounded by this environment, not by the natural environment - the "first" and "second" nature, especially the "first" nature, which creates only the foundation on which the whole complex of anthropogenic changes is imposed. In some cases, the environment of the "second" and "third" nature mitigates the impact of the natural environment (for example, improves the microclimate), in others it replaces the natural environment with its elements (informative architecture, the impact of air conditioning, etc.).

Very often, the arte-natural environment is sharply deteriorated, especially in terms of physical, chemical and informational indicators (pollution of all kinds, monotony of architecture, etc.). Comparison of the "natural optimum" with the factors of influence of the "second" and "third" nature allows us to determine the direction of the controlling influence aimed at optimising these "natures".

Social environment is a cultural and psychological (informational, including political) climate that is intentionally or unintentionally, consciously or unconsciously created for individuals, social groups and humanity as a whole by people themselves and consists of the influence of people as social and biological beings on each other in collectives directly and with the help of the means of material, energy and informational influence invented by them. This influence includes:

- economic security, which should meet the standard of a given society or a given ethnic or social group (housing, food, clothing, other consumer goods);

- civil freedom (of conscience, expression of will, movement, place of residence, equality before the law, etc.);

- degree of confidence in the future (absence or presence of fear of war, other severe social crisis, job loss, change of job direction, hunger, imprisonment for beliefs, gang attack, theft, inevitable chronic or unexpected illness, family breakdown, unplanned growth or reduction, and so on);

- moral norms of communication, freedom of expression, including freedom of labour activity (maximum commitment of forces and abilities to people and society, receiving signs of attention from them);

- the possibility of free communication with people of a similar ethnic and cultural level, i.e. the creation and entry into a social group that is a reference for a person (with common interests, life ideals, behaviour, etc.);

- the opportunity to use cultural and material assets (theatres, museums, libraries, goods, etc.) or the awareness of such an opportunity;

- accessibility or awareness of the accessibility of generally recognised holiday destinations (resorts, etc.) or seasonal (temporary) changes in the type of accommodation (up to a tourist tent);

- provision of a social and psychological spatial minimum that allows avoiding nervous and psychological stress from overcrowding (optimal frequency of meetings with other people, including friends and relatives);

- comfort of the service sector (absence or presence of queues, quality of service, as appropriate).

The social environment is integrated with the natural, quasi-natural and arte-natural environments into the common totality of the human environment. All the factors of each of the environments under consideration are closely interconnected and constitute the objective and subjective aspects of the "quality of living environment".

At the same time, the entity is inseparable from the psychologic, and this deep connection may not be realized. In no case should we assume that any of the subsystems (the natural environment, each of its two anthropogenic modifications, and the social environment) can replace the other or be painlessly thrown out of the overall system of the human environment.

Subsystems can only strengthen or weaken each other's effects, but not cancel them. For example, natural climatic discomfort can be mitigated by better

organisation of the "third nature" and by social optimum, but this does not mean that the living human environment would be ideal.

N.F. Reimers believed that the social environment, together with the natural, quasi-natural and arte-natural environments, forms a common totality of the human environment. Each of these environments is closely interconnected with the others, none of which can be replaced by another or be painlessly excluded from the common system of the human environment.

2.2 Social components of the environment

According to D. Markovich, the most significant elements of people's social environment can be called social relations, labor environment and settlements (village, city, local associations). Identifying these elements of the social environment is important for understanding the relationship of a man or a social group to the living environment.

Social relations in the broad sense are the human interactions. This interrelated behavior of people changes the behavior of each participant involved in the relationship and leads to some changes. In the narrow sense, social relations are a type of social process. By engaging in a particular process, i.e., in a joint activity, people thereby occupy a different position in relation to one another and thus create different social relations.

The labor environment is a set of material factors of the labor process and interpersonal relationships, which are established by participants in the labor process. People create the labor environment and affect it, but the labor environment as a whole or by separate elements also affects people.

The living environment is represented by settlements, which express the population, i.e., the distribution of inhabitants on the earth, and which is influenced by numerous geographical, historical, social, and economic factors.

All elements are in constant interaction, which leads to the constant deterioration of the human environment.

Before humans, a harmony of relationships and dependencies had dominated in the biosphere, but then begins the formation of an artificial environment at the expense of nature (the creation of artifacts). This process was accelerated by the beginning of the Industrial Revolution.

It is precisely industrialization and urbanization that have distanced man from nature and placed him in a special situation: the basis of his existence in the world was no longer his initial natural certainty, a special environment was formed, in which Leonardo da Vinci saw "man's second nature".

The human living environment is significantly influenced by population size, growth, location, and the socio-economic structure of the population. These factors are operating synchronically. Population growth is related to the growth of needs, and these needs are becoming more and more sophisticated.

The dynamics of world population growth over the past centuries: in 1750 the number of earth's inhabitants was between 629 and 961 million people, in 1900 - 2.5 billion people, in 2000 - about 6.2 billion people; in 2020 - 7.9 billion people.

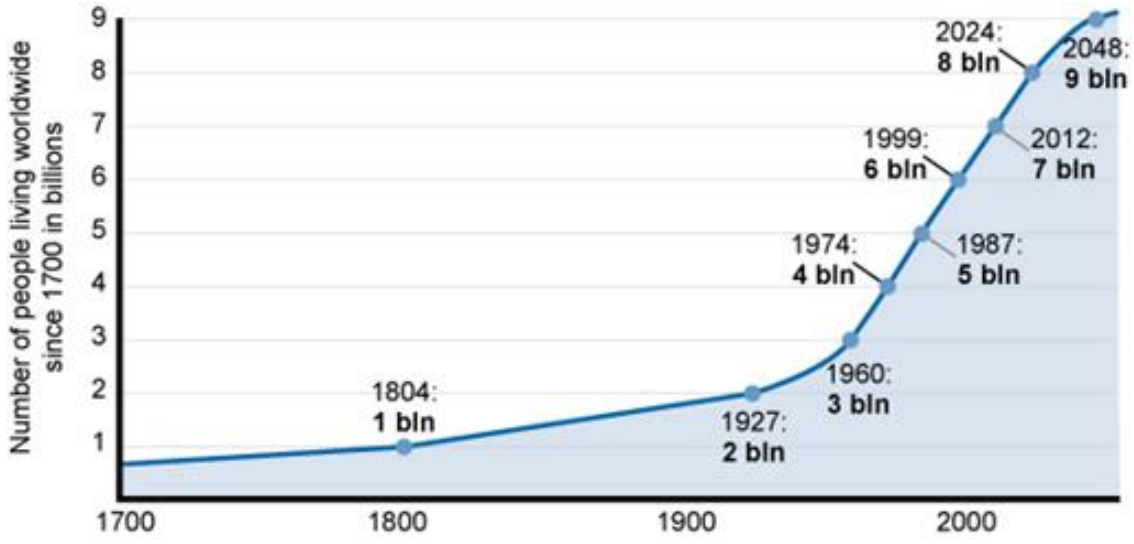


Figure 2.5. Population growth globally

The pressure on nature is steadily increasing, which has led to three significant disruptions in the demographic-ecological regime:

1) chronic hunger;

2) energy crisis;

3) severe degradation of the urban environment.

2.3 General principles of protection of the living environment

The most general principle or rule of nature conservation can be considered the law of “shagreen skin”: the global initial natural-resource potential is continuously depleted in the course of historical development, which requires humanity's scientific and technological excellence aimed at wider and deeper utilisation of this potential.

There is a misconception that the way out of the ecological crisis is through so-called waste-free theologies. That this opinion is erroneous is evidenced by the fact that the biosphere contains a large amount of biogenic geological rocks.

In the case of economic activity, there is a law - the law of the impossibility of eliminating waste and side effects of production (economy): in any economic cycle, waste is generated, and the resulting side effects cannot be eliminated, they can only be transferred from one physical and chemical form to another or moved in space (otherwise, the law of conservation of mass and energy would be violated).

The total amount of waste in the form of substances, energy and side effects is actually constant: only the place of its origin, the time of its formation and its physical-chemical or biological form change in production cycles. Therefore, the law of impossibility of waste elimination can be supplemented by the law of constancy of the amount of waste in technological chains.

For example, the conversion of vehicles to electric traction requires the production of electricity and therefore the extraction of primary energy carriers (coal, oil, nuclear fuel, etc.), the construction of power plants, power grids, recharging stations, etc. This series is no better or worse than the series of direct production and refining of oil into petrol and diesel fuel in terms of the amount of waste.

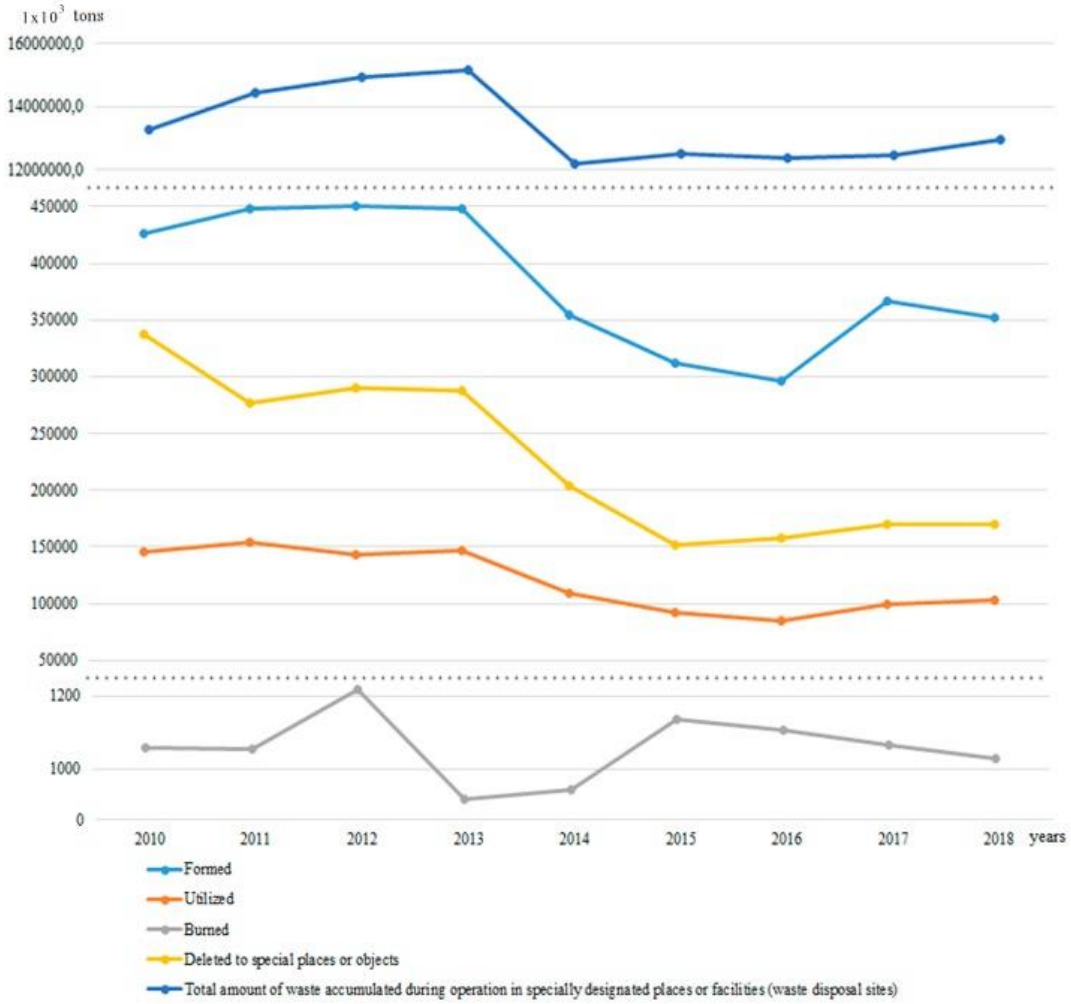


Figure 2.6. Waste generation and management in Ukraine in 2010-2018

Cleaning - the process of only changing the physical and chemical form of substances and moving the polluting agent in space. It has a small (mostly temporary, local) effect and requires large energy inputs.

The more sustainable the approach to natural resources and habitats, the lower the costs required for successful development. For example, scientists have calculated that in Brazil, spending $10 billion to install more efficient refrigerators, street lighting, motors, etc. could eliminate the need to build new energy sources, saving $44 billion.

Hence the rule "ecological - economic as one of the leading principles of nature and living environment protection: preservation of resources is always

beneficial in social and economic relations, and also leaves time for cardinal solution of demographic problems.

The effect of these laws is especially noticeable now, when the planet's resources have been significantly reduced. Therefore, the market describes certain norms of exploitation of natural resources and living environment. These norms are set according to the reserves of natural resources on the basis of the laws of component and territorial ecological equilibrium, their non-fulfilment leads to the devastation of natural resources.

The "iron laws of nature protection" set forth in 1980 by P. R. Ehrlich:

1. In conservation, only successful defence or retreat is possible. A species or ecosystem, once destroyed, cannot be restored. This law is a reflection of the law of irreversibility of evolution. Practically it coincides with the law of irreversibility of human-biosphere interaction of P. Dansereau.

2. Continued population growth and nature protection are fundamentally contradictory. There has been oversaturation, absolute overpopulation of the planet, which is fraught with the action of environmental factors that depend on population density.

3. The ecological system engaged in excessive growth and nature conservation are fundamentally contradictory. Humanity's desire for gigantism is genetically embedded in human psychology. Growth is its main goal, but the grandiose is very vulnerable in evolutionary and historical development.

This does not mean that all growth must stop. Only the type of growth itself should change: from extensive to intensive, from quantitative to qualitative, etc. (taking into account reasonable and probable risks).

Scientists believe that in the future the motto: "Small but perfect, functionally greater at less cost" will become the main motto. A small cultured people, a small livable city, a small enterprise, etc. is better than a wild crowd of hungry people, a rumbling megalopolis, a giant that pollutes the nature and cannot be managed.

4. It is deadly for everyone, including human beings, to think that when deciding how to use the Earth, one must have only one immediate goal in mind: the good of human beings. This law is a reflection of systemic laws operating in constant interrelationship; violation of each can have unforeseen consequences. Only the greening of all human activities can partially improve the situation.

5. Nature conservation should be considered a matter of human welfare and survival.

Another law of nature protection should be added - the principle: everything that is non-repeatable and unique deserves special protection. Unique beauties are preserved in national parks as a world heritage of mankind.

But preserving everything and anything is of course impossible. For example, there are environmentally dangerous enterprises that cannot be liquidated. It should be assumed that everything is good when a certain measure is observed. The law of optimality in nature and environmental protection can be formulated as the principle of reasonable expediency and risk tolerance: the expansion of any human actions should not lead to socio-economic and environmental disasters that undermine the very possibility of human existence.

The correctness of this law can be convincingly seen in the example of nuclear power plants (NPP). From the very beginning, no safe technology for storing NPP waste was developed, so it was worth limiting their construction until this problem was solved. But mankind has followed the path of intensive construction of NPPs, increasing the danger of radioactive contamination of waste storage sites. The absolutely dangerous limit has not yet been reached. But is it worth striving for it? If accidents at NPPs can be at least theoretically prevented, contamination of territories due to accumulation of radioactive waste can hardly be prevented due to our limited knowledge in this field and unpredictability of waste migration paths in ecosystems.

Thus, the principle of reasonable sufficiency in the development of the nuclear industry has been violated. In this case we have a situation when the principle of

incompleteness of information (the principle of uncertainty) is in force: information on conversion actions and any changes in the natural environment in general is always insufficient for a priori conclusions about all possible consequences of such actions, especially in the distant future, when all natural chain reactions will develop. The range of possible processes is much wider than our knowledge.

Self-control questions to Topic 2:

1. Give the definition of Human environment.

2. The human environment consists of two interrelated parts:

a) natural and economic;

b) natural and social;

c) natural and environmental.

3. The elements of the natural environment include the atmosphere, hydrosphere, lithosphere, …, animals and microorganisms (fill in the omitted word).

4. According to D. Markovich, the most significant elements of people's social environment are:

a) settlements;

b) labor environment;

c) behavior;

d) social relations.

5. What factors significantly affect the human living environment?

6. Three significant disruptions in the demographic-ecological regime are:

a) chronic hunger;

b) culture crisis;

c) energy crisis;

d) radiation;

e) severe degradation of the urban environment.

7. Which law should be considered the most general rule of conservation?

8. The … the approach to natural resources and the environment, the … the costs required for successful development. (fill in the missing words)

9. Which of P.R. Ehrlich's "iron laws" is a representation of the law of irreversibility of evolution?

Section 3.
HUMAN ADAPTATION TO THE NATURAL AND SOCIAL ENVIRONMENT

3.1 Socio-environmental interaction. Human adaptation to environmental conditions

The most important aspect of the study of the relationship between humans and the environment is the study of the problem of human adaptation to the environment and its changes.

Throughout the world history, humanity has evolved as part of the Biosphere as part of it. That is, humanity was connected to the Biosphere and to its control mechanisms like any other species.

At the present stage, humanity is faced with the problem of conscious harmonization of its interaction with the physical environment - mutual adaptation.

Adaptation is a purposeful system of body reactions, which ensures the possibility of all types of social activity and activity under the influence of factors, the intensity and extensity of which leads to a disturbance of homeostatic balance.

Adaptation takes its conceptual glory from the theory of evolution. One of the first writings to suggest the notion of the evolution of life by adaptation to the milieu was Aristotle. He dealt with “The influence of climate on animals” and “The influence of the milieu on the behavior of animals” and defended a teleological vision in which all biological development takes place within a final, pre-established perspective.

The modern idea of an evolutionary adaptation comes from the notion of adaptation to the natural environment, the back bone of Lamarck’s theories (1809). Lamarck saw in living beings the capacity to stick to “influent circumstances”. This transformist adaptation was perceived as a continuous effort of the living to benefit from the milieu in which it evolves.

Table 3.1. Summary of various definitions of adaptation and associated concepts according to several fields *(Source: http://sapiens.revues.org/index997.html)*

Field	Definition	Associated concepts
Biology	"By saying Biological adaptation, we mean all internal and external correlations (organism-milieu relations) that allow an organism to live in a certain manner in a given habitat, and to contribute to the perpetuation of the species to which it belongs" (Boquet, 2002)	Evolution Interaction Acclimatization
Psychology	"The process that surrounds the unceasing interaction between Man and the dynamic world in which he evolves and interacts" (Jakubowicz, 2002)	Equilibration Habituation
Anthropology	The process through which organisms or populations of organisms make biological or behavioral adjustments that will facilitate or assure their reproductive success and therefore survival in their environment. The success or failure of adaptive responses can only be measured on a long-term basis and the consequences of the observed behaviors on evolution are not predictable (Bates, 2005)	Adjustment Behavior
Sociology	Despite **intertwined** roots with biology, sociology seldom uses the concept of adaptation, preferring the terms acculturation, deviance or even socialization. Nevertheless, the concept of adaptation exists by social adaptation, which dwells on changes in the individual at the origin of the development of aptitudes, to integrate and acquire the feeling of belonging to a group". (Boudon, 2002)	Integration Socialization Acculturation
Geography	The Chicago School of Geography borrowed the concept of adaptation from ecology to define it as the fruit of deliberate choice, so as to escape the constraints of the milieu, thus distancing itself from biological determinism descended from natural selection and leaning more on the notion of adjustment: "the object of geography is the adjustment of Man to the environment and not to the influence of this environment" (Barrows, 1923)	Adjustment

The Darwinian explanation of a natural selection as an evolving, driving force eclipsed the Lamarckian adaptation, which was then perceived as a simple result of

evolvements and not a process, before the former also came to a dead end when faced with the rediscovery of work in genetics and the notion of organization.

Rabaud's work on biological adaptation (1922) and, subsequently, Cuénot's (1925) marked the beginning of a prosperous era for the enrichment of the notion of adaptation. In the second half of the 20th century, contributions were made by new sciences, such as cybernetics, and the advancements in information theories, as well as thermodynamics of open systems.

Today adaptation became a central concept in several major social disciplines, such as psychology, anthropology and geography, as well as in many fields of biology.

In each discipline, ***environment is strongly linked to the concept of adaptation***. Because of the acceleration of global environmental and socio-economic change, there is a growing interest in adaptation in environmental science.

3.2 Environmental and social stressors

Since the existence of human, his health has been formed and continues to be formed under the influence of environmental factors.

Human has adapted to the environment in the process of evolution and cannot live without it, because it is common to his inner environment.

This interaction should not disrupt the adaptive mechanisms of the human body, because from the beginning of embryonic origin to the end of his life a human comes into contact with environmental components (air, water, soil, food, etc.).

Adaptive factors in the evolutionary development of the human body are manifested in extreme situations, when the body is suddenly affected by stimuli, as well as due to changes in the general conditions of its existence.

In relation to humans, stressors (stress factors) are inherently natural (environmental) and social (cultural) (Fig. 3.1.).

Environmental factors of human adaptation. Human as a result of the development of nature is evidence of the inseparable interaction of abiotic natural factors and living organisms.

Environmental factors that determine the development of adaptation mechanisms are always complex. From the very beginning, all living organisms adapted to the earth's living conditions (barometric pressure, gravity, radiation, the state of the planet's gas shell, the chemical composition of food, etc.).

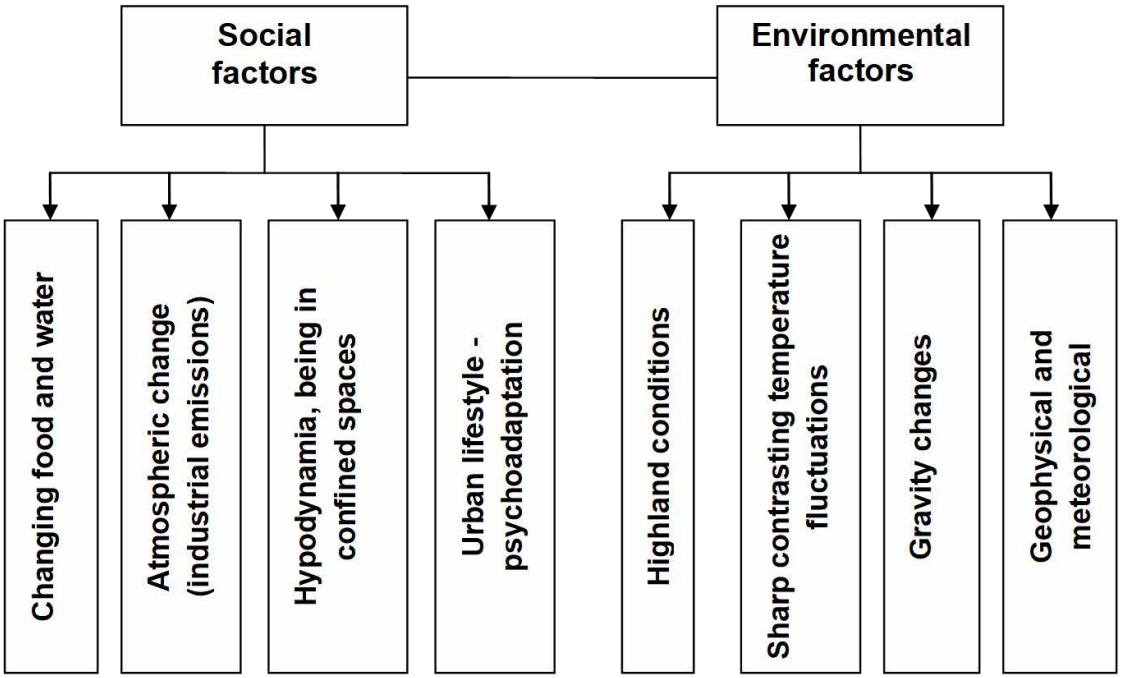


Figure 3.1. Stress factors

In the process of evolution, the human body has adapted to the natural change of the seasons, each of which is characterized by a certain temperature, light, humidity, radiation fluctuations. In this regard, an important role is played by the mechanism of previous changes in the body, such as hardening, which ensures the body's resistance to temperature changes.

In addition to seasonal changes, the human body adapts to changes of day and night, physiological biorhythms.

Social factors of human adaptation. Social conditions of human life, especially factors related to his work, have created a specific environment to which his body also needs to adapt. The number and direction of these conditions develops in proportion to the development of civilization.

For example, with the deployment of space exploration, man had to adapt to a state of weightlessness that causes hypodynamia (disorders of body function, especially the musculoskeletal system, blood circulation, respiration, digestion, caused by limited motor activity, and decreased muscle contraction), changes in daily biorhythms and more.

Social factors are work in deep underground mines, deep dives, work on high-temperature technologies or in too cold conditions.

Human has to adapt to living in conditions of changing light, high noise, environmental pollution, food with high content of synthetic products and so on.

In the process of development of society, the conditions of human production have also changed, evidence of which is the replacement of physical labour by machines and mechanisms that reduce physical activity, leads to hypodynamia, stressful situations, which negatively affect all body systems.

The number of stressors is especially growing at the present stage, with rapid technogenic development, which modifies and increases the number of both social and environmental stress factors.

At the present stage of its development, humankind has greatly expanded the boundaries of its residence and activities. Today, it is possible and even necessary to live in conditions that are radically different from those in which humanity was born and evolved over millennia.

Development of areas with extreme natural conditions (with too high or low temperatures of high mountain areas where there is a lack of oxygen), introduction of new technologies, which force employees, for example, with a significant reduction in physical activity to feel too high psychological load and responsibility,

cause an imbalance between the biological nature of human and the necessity to adapt to ever-changing conditions.

3.3 General patterns of human adaptation

Adaptation of organisms to environmental conditions occurs in the following areas:

a) genetic adaptation − the ability of organisms distributed over a large geographical area to form ecotypes (populations) adapted to specific natural conditions;

b) biochemical adaptation − the ability of organisms to change their metabolic activity (metabolism) and chemical reactions, which allows to preserve life processes in new environmental conditions;

c) morphological adaptation − adaptation at the level of cells and tissues of the body;

d) physiological adaptation − a set of physiological features that ensure optimal functioning of organisms in stable or changing external conditions.

Depending on the type and characteristics of the impact on human body, there are the following **groups of adaptation processes**:

a) mutational adaptation − the evolution of a population, which culminated in the creation and formation of races;

b) modification adaptation − the process of human acclimatization to changes in environmental conditions;

c) modulation adaptation − direct human adaptation to rapidly changing environmental conditions (positive or negative reactions to short-term changes).

In far from optimal conditions of existence the human's biological and labour activity decreases, and in a certain environment the human organism cannot exist at all. For example, a person without special training will not be able to fully work and live permanently in the highlands (at an altitude of more than 5000 m) or in the arid (dry) zone of the desert at an average air temperature of +40° C.

It is best if everyone has the opportunity to live in an optimal place for themselves, where their physiological systems would coexist harmoniously with the physical and social environment, which is a prerequisite for maintaining long-term working capacity.

Otherwise, his body is forced to adapt to the external environment, and the form, content, duration of adaptive activity as well as acquired qualities are determined by the characteristics of this environment.

This human activity is universal and covering climate-geographical, physiological, social and other aspects. Evidence of adaptation of the organism to unusual living conditions can be members of Arctic expeditions, astronauts, submariners, representatives of other professions.

The first form of human adaptive activity is **genotypic adaptation**, as a result of which modern species of living organisms have been formed on the basis of heredity, mutations and natural selection.

The complex of species hereditary traits (genotype) is the basis of individual adaptation, which occurs in the process of interaction of a particular organism with the environment and is provided by specific environment structural changes.

In the process of individual adaptation, a person creates reserves of memory and habits and forms vectors of behaviour. The genetic program of the organism provides an effective focus of vital adaptive responses to environmental influences. Each new generation of people adapts in its own way to many factors that require a kind of specialized reactions.

According to research, the active adaptation of the organism to one factor improves its resistance to a complex of other factors, after which the organism acquires a new quality. Under such conditions, adaptive reactions are formed, which increase resistance to overload, extreme temperatures, physical performance and inhibit the development of many pathologies.

The ways in which an individual (society) adapts to changing conditions of existence are described in the anthropo-ecological and socio-ecological literature as **adaptive strategies**.

Adaptive behaviour of living organisms can be realized in the form of escape from an adverse stimulus, passive submission to it, and active resistance to the environment due to specific adaptive reactions.

Various representatives of the plant and animal kingdoms (including humans) most often use a passive strategy for adapting to changes in the conditions of existence. It is a response to the effects of adaptive environmental factors, consisting in morpho-physiological transformations in the body, and aimed at maintaining the constancy of its internal environment.

One of the key differences between humans and other representatives of the animal kingdom is that humans are much more frequent and successful in applying a variety of active adaptive strategies, such as, for example, as strategies of avoiding and inducing the action of certain adaptive factors.

However, the most developed form of an active adaptive strategy is a specific for people economic and cultural type of adaptation to the conditions of existence, which is based on the object-transformative activity that they perform.

3.4 Human behaviour in the natural and social environment

Human behaviour in the natural environment. The concept of "natural environment" has a very different meaning for humans than for animals. Animals and plants live directly in nature and are merged with it, subject to its laws. For man, living in a forest, cave, desert, without food and water is disastrous: even if he survives, his life will be only an existence. That is, speaking of human habitat, we understand a complex of natural and artificial conditions.

When an individual chooses a behavioural option, he/she is influenced by the following elements of the environment:

1) culture (moral attitudes, norms, values learnt by the individual, as well as norms and values dominating in his microsociety);

2) stress factors and other sources of tension;

3) physical and social conditions necessary for normal life activity.

Two interrelated aspects can be distinguished - spatial and temporal. As for the first aspect, i.e., spatial, it has long been known that human behaviour acquires its specificity depending on the place where it is located or permanently resides.

As an example, we can cite the influence of climatic conditions on the character of behaviour. It is known, for example, that southerners are more sociable, boisterous and talkative in their behaviour; northerners are more reserved, detailed and less expansive.

In addition, a person's behaviour is influenced by the very way of life determined by place. The behaviour of a city dweller differs significantly from the behaviour of a villager, moreover, the behaviour of a metropolitan dweller differs from the behaviour of a provincial city dweller.

Human behaviour is influenced by the very environment of the place where a person is: forest or field, town or village, shop or school, café or theatre. And people behave according to the role they play, according to the situation.

P. Barker combines human behaviour and the environment into a single eco-behavioural system. To describe this system, he introduces the concept of "place of behaviour", which is an objective spatial and temporal situation with a certain set of behavioural forms inherent in it. For example, the central square in a city is one "place of behaviour" of people during various holidays and quite another on weekdays.

The temporal aspect of the influence of the natural environment on human behaviour can be described in a similar way. Each individual is a product of his/her time, lives and thinks in terms of his/her epoch, evaluates the past in terms of what he/she is experiencing now, at this moment, at the present time.

There is a certain steady tendency when the past is assessed with scepticism and condescension, and the future is perceived with some apprehension and hope at the same time. Even modern exact sciences are assessed as more significant than the achievements of sciences in the past.

Each of us would not want to live in the past, but would gladly live in the future if given the opportunity. Nevertheless, human behaviour throughout life is subordinated to the circumstances of time. Having lived 20, 30, 50 and more years, he reacts differently to similar situations, which is conditioned both by the passage of time itself and by the experience that a given person acquires. But this already goes beyond the framework of human behaviour in the natural environment and concerns the problems of human behaviour in the social environment.

Human behaviour in the social environment. Human behaviour will differ significantly depending on belonging to a particular nation, a particular group, this or that society; it will be different in everyday life and at work, in an educational institution and on the street:

1) the behaviour of a particular individual is determined by his belonging to a nation. It is not without reason that in science the problem of national character is posed as an independent one.

There are a lot of stereotypes, i.e., schematisations and simplifications, where an attempt is made to describe in a concise way some character and the manner of behaviour defined by it. For example, the English are prim and traditional, the Germans are punctual and consistent, the French are sociable and in love. Undoubtedly, all these are simplifications, and sometimes unjustified, but nevertheless there is some truth in them.

2) a person's behaviour is necessarily determined by his religious affiliation. Muslims are characterised by a heightened sense of Muslim identity, to the point of opposing others - non-Muslims; Hindus, on the contrary, are very tolerant; a Christian is inclined to moral evaluation, ethical analysis of what is going on; a Buddhist adheres to the tactics of distancing, and so forth.

National and religious can combine in the most bizarre way, determining an individual-national style of behaviour, which is expressed in special views, traditions, assessments, prohibitions.

3) a person's behaviour is largely determined by the group within which his social life takes place.

Each group, ranging from large ones, such as society, to small ones, such as a labour collective, a family, etc., forms views, attitudes, values inherent in its members, which determine a person's peculiar behaviour. Each group develops its own special code of behaviour, its own rules. Therefore, a person's behaviour at work will be somewhat different from his behaviour at home.

Moreover, behaviour is significantly determined by the place a person occupies in his group: a superior or a subordinate, a leader or a slave, a person who enjoys authority or occupies a low status.

Depending on his position, he also performs a certain role, which is reflected in the manner of behaviour - in one case he tends to dominate others, take the initiative, manipulate people, in the other - to obey, yield, agree, do the will of others.

4) a person's behaviour is determined by his internal environment. Here two aspects are distinguished: 1) physical state; 2) psychological state. The first aspect is related to the state of the organism, the second to the state of the person as an individual.

It is well known that if a person is unwell, if he feels unwell because of an ailment, his behaviour will be characterised by irritability, apathy, inadequate assessments, etc. On the contrary, good physical condition to a greater extent stimulates performance, the ability to react adequately to stimuli and make the right decisions.

The psychological state of the inner world has an even greater impact on behaviour. If a person has a positive self-concept, high self-esteem, if he is satisfied with himself, then his behaviour is more open, friendly, adequate to the situation. In

case he experiences intrapersonal conflicts, is dissatisfied with himself, defends himself from others, his behaviour is aggressive, inadequate, and protective.

Considering that a huge number of people live in large cities, we find it interesting to give a description of *crowding* - the stress that is subjectively experienced by a person due to lack of space.

Daniel Stokols (University of California, Irvine), one of the most active researchers of this phenomenon, proposed the following classification of situations in which crowding occurs. He distinguishes two milieus: primary, in which a person spends a significant part of his time, is familiar with the environment (e.g., classrooms, offices, living quarters) and secondary, in which meetings with people are temporary and have no further continuation, consequences (e.g., places of recreation, transport).

Stokols further subdivides all human interactions with the environment into: neutral, which are not directed at a particular individual and are perceived by the individual as unintentional; and personal, which are directed at a particular individual. Different combinations between types of environment and types of interaction and corresponding human behaviour are possible.

This list could be considerably continued. We can talk about the influence on human behaviour of the aesthetic environment, including the perception of the beautiful in nature, painting, literature, music, etc., the scientific environment (it is not by chance that they talk about the uniqueness of physicists and lyricists), the sporting environment, where the struggle for the perfection of one's body is extrapolated to all other aspects of life.

As an example, let's take a closer look at the influence of the aesthetic environment on human behaviour. There are the following factors that determine the attractiveness of the environment. The first factor is connected with the past experience of a person (pleasant and beautiful things are evaluated most often through correlation with habitual experience); the second factor is determined by the biological need in orientation activity (getting pleasure when solving uncertain

situations in an unpredictable environment); the third factor is connected with aesthetic principles (principles of harmony, symmetry, golden section).

There is another very important aspect - the behaviour of the individual in the organization. There are different points of view on human behaviour in an organization.

Thus, some authors believe that each person has individual differences that are stable and persist in different situations throughout life, then the behaviour of this person is explained by his/her individual characteristics, which makes a person unique. Others, on the contrary, argue that the main influence on human behaviour is exerted by the environment, therefore, the main attention should be paid to the situation in which a person finds himself, rather than to his individual characteristics.

All of the above illustrate the position on the variability and peculiarity of human behaviour from the surrounding conditions of the external and internal world.

3.5 Needs as a source of activity of personality. Characterisation of ecological needs

Activity as a central component of human behaviour does not arise spontaneously by itself, but is determined by certain states of man as an organism, social individual and personality, expressing his dependence on the environment: material, social, and spiritual.

In other words, *a need* is a requirement, a necessity for something. It is needs that are the basis for the emergence of motives - the direct drivers of behaviour.

Human needs are very diverse. N. Reimers, based on the generalisation of literary materials, distinguishes the following groups and types of needs:

- by character and nature of occurrence: natural, social, intellectual;
- by sphere of life activity: material and spiritual;
- by economic quantification: absolute, actual and solvent;
- by degree of specificity: general and specific;
- by degree of satisfaction: satisfied, unsatisfied;

- by degree of urgency: urgent, less urgent, distant;

- by objects: in material goods, services and spiritual values;

- by degree of activity: active and passive;

- by degree of rationality: rational and irrational ("pseudo-needs");

- by degree of reality: realistic and unrealistic;

- by the degree of perspective: socially promising and unpromising.

In terms of content, they distinguish:

- biological: the need for heat, air, food, water, sexual partner and many others;

- ecological-behavioural (psychological): the need for dominance and subordination, creation of one's group (family), style and pace of life, etc;

- ethnic: the need to belong to a certain clan, clan, nation, ethnic integrity, etc;

- social (and socio-psychological): the need for communication, in the possibility of forming social groups;

- labour: the need for work, achievements, success in activities, etc.;

- cognitive: the need for knowledge, education;

- economic: the need to provide food, clothing, housing, means of labour in accordance with anatomo-physiological, ethnic, prestige norms;

- others (aesthetic, constitutional, communicative, etc.).

Abraham Maslow's hierarchy of needs is one of the best-known theories of motivation. Maslow's theory states that our actions are motivated by certain physiological and psychological needs that progress from basic to complex.

A. Maslow argues that an individual's needs depend on what he or she already has. He arranged needs in the form of a pyramid, at the base of which are physiological needs (water, food, sleep, breathing), then towards the top he placed the needs for protection and security, belonging (public and personal), self-assertion and independence, self-expression.

Maslow's hierarchy of needs is often displayed as a pyramid. The lowest levels of the pyramid of needs are made up of the most basic needs while the most complex needs are at the top.

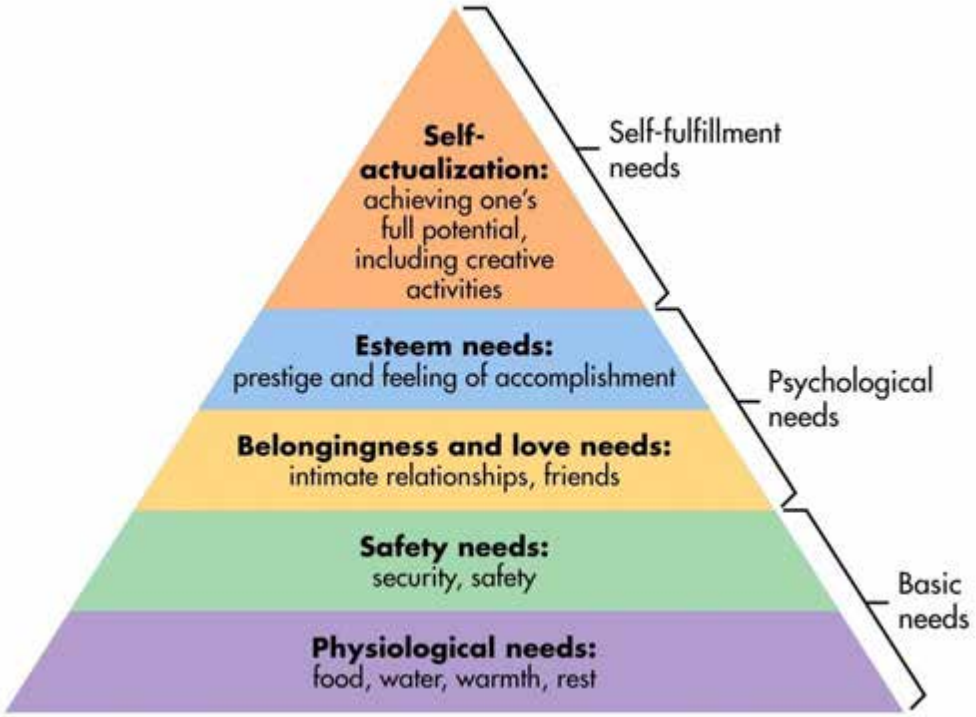


Figure 3.2. Maslow's Hierarchy of Needs

Physiological Need. The physiological needs include those that are vital to survival. Some examples of physiological needs include:

- ✓ Food
- ✓ Water
- ✓ Breathing
- ✓ Homeostasis

In addition to the basic requirements of nutrition, air, and temperature regulation, physiological needs also include shelter and clothing. Maslow included sexual reproduction in this level of the hierarchy as well, since it is essential to the survival and propagation of the species.

Security and Safety Needs. At the second level of Maslow's hierarchy, the needs start to become a bit more complex. At this level, the needs for security and safety become primary. People want control and order in their lives. Some of the basic security and safety needs include:

- ✓ Financial security
- ✓ Health and wellness
- ✓ Safety against accidents and injury

Finding a job, obtaining health insurance and health care, contributing money to a savings account, and moving to a safer neighborhood are all examples of actions motivated by security and safety needs.

Together, the safety and physiological levels of Maslow's hierarchy of needs make up what is often referred to as "basic needs."

Social Needs. The social needs in Maslow's hierarchy include love, acceptance, and belonging. At this level, the need for emotional relationships drives human behavior. Some of the things that satisfy this need include:

- ✓ Friendships
- ✓ Romantic attachments
- ✓ Family relationships
- ✓ Social groups
- ✓ Community groups
- ✓ Churches and religious organizations

In order to avoid loneliness, depression, and anxiety, it is important for people to feel loved and accepted by others. Personal relationships with friends, family, and lovers play an important role, as does involvement in groups—such as religious groups, sports teams, book clubs, and other group activities.

Esteem Needs. At the fourth level in Maslow's hierarchy is the need for appreciation and respect. Once the needs at the bottom three levels have been satisfied, the esteem needs begin to play a more prominent role in motivating behavior.

At this level, it becomes increasingly important to gain the respect and appreciation of others. People have a need to accomplish things, then have their efforts recognized. In addition to the need for feelings of accomplishment and prestige, esteem needs include such things as self-esteem and personal worth.

People need to sense that they are valued by others and feel that they are making a contribution to the world. Participation in professional activities, academic accomplishments, athletic or team participation, and personal hobbies can all play a role in fulfilling the esteem needs.

People who are able to satisfy esteem needs by achieving good self-esteem and the recognition of others tend to feel confident in their abilities. Conversely, those who lack self-esteem and the respect of others can develop feelings of inferiority.

Together, the esteem and social levels make up what is known as the "psychological needs" of the hierarchy.

Self-Actualization Needs. At the very peak of Maslow's hierarchy are the self-actualization needs. Self-actualizing people are self-aware, concerned with personal growth, less concerned with the opinions of others, and interested in fulfilling their potential.

"What a man can be, he must be," Maslow explained, referring to the need people have to achieve their full potential as human beings.

Maslow's said of self-actualization: "It may be loosely described as the full use and exploitation of talents, capabilities, potentialities, etc. Such people seem to be fulfilling themselves and to be doing the best that they are capable of doing. They are people who have developed or are developing to the full stature of which they capable."

According to Maslow's theory, an individual first seeks to satisfy lower (essential) needs before moving on to self-expression.

K. Alderfer agrees with A. Maslow that individual needs can be placed in the form of a hierarchy. But it has three stages:

1) existence - factors that fulfil the need to exist (food, air, water, wages, working conditions);

2) affinity - needs satisfied by significant social and interpersonal relations (friendship, communication, love);

3) development - needs satisfied by the personal creative or productive growth of the individual.

F. Herzberg's research resulted in two specific conclusions:

1. There is a set of external conditions that satisfy the worker, if any, but do not necessarily motivate him. These are wages, working conditions, quality of management, job security, relations with colleagues. In the absence of these conditions, there is dissatisfaction among workers. F. Herzberg called such external conditions hygienic factors or dissatisfaction factors.

2. There is a system of internal conditions related to the content of the labour process (recognition, responsibility, promotion, work itself, etc.), the absence of which is not an indicator of a high degree of dissatisfaction. And their presence in the labour process gives strong motivational incentives. F. Herzberg called them motivation (satisfaction) factors.

American psychologist David C. McClelland (1987) believes that humans have three acquired needs:

- for achievement;
- for belonging;
- for power.

This list could be considerably continued. In modern psychology, sociology, and economics, there are a lot of different classifications trying to describe human needs in any way fully. However, no one has succeeded so far. And this situation is understandable.

The point is that human behaviour is diverse, practically any "object" can stimulate the emergence of one or another need. For example, the need to have the same car as a neighbour, or the need for loneliness and the need for spiritual intimacy, or the simultaneous need for both (needs, like emotions, can be ambivalent).

In connection with the topic under consideration we would like to highlight ecological needs, it is they that condition and determine the ecological behaviour of

a person. First of all, it should be noted that they cannot be singled out in any special group, as they characterise not only and not so much the specific content, but the qualitative characteristics of the existing diverse needs.

For example, let us take biological needs in food, water, air. These biological needs can have absolutely different qualitative ecological colouring. Some people drink any water, and some drink only purified water, some eat any food, and some eat only food without impurities, chemicals, nitrates, etc.

In other words, ecological needs are needs related to the cleanliness of the habitat, the living environment in general. For example, the needs for clean water, clean air, quality food, purity of people's relations, purity of nature itself, hence the needs derived from them: the need to make air, food, water, relations clean, which determines the appropriate behaviour in the habitat, in one's living environment, which includes the world of nature, the world of people, the world of ideas and much more.

In accordance with the above, the problem of educating human ecological needs is of topical importance. The solution of this problem will allow a person to learn to live in harmony with nature, with other people, with himself.

By and large, this is what it means to make a person a spiritual, moral, responsible being in the truest sense of these words.

3.6 Strategies for long-term human adaptations to the environment

The most important component of human energy intake is the basic metabolism, or basic metabolic rate. This is the level of energy expenditure of the organism that is maintained at neutral ambient temperature, at rest (but not in sleep), after digestion of the consumed food.

Basic metabolism depends on age, sex, body size, and functional state of the organism.

Many researchers reasonably assume that mean values of basic metabolism differ among inhabitants of different climatic and ecological niches (however, this assumption has not been conclusively proven).

Even if this were true, the range of differences in basic exchange between the most "contrasting" groups (Arctic natives with "high" and tropical forest dwellers with "low" basic exchange) is not likely to be more than 15-20 per cent, according to various estimates.

In view of this, it may be supposed that to meet the needs associated with the basic energy metabolism, a person of modern physical type should receive about 1800 kcal (7.5 MJ) of energy per day with food.

There are no grounds to think that the needs for energy intake with food are essentially different for both a resident of New York, Kyiv, Tokyo, and an ancient hunter of extinction buffalo in Kyivan Rus.

However, it is clear that different strategies for energy conservation and its replacement (nutrition) are desirable for each of them. These strategies are based on long-term adaptations to the living environment: both *biological* (formation of adaptive types) and *cultural-economic* (formation of various subsistence systems).

The long-term biological adaptive response of human populations results in the formation of an adaptive type (a response norm that occurs in a convergent manner under similar conditions of existence).

Researchers have identified adaptive types of temperate climate, continental arctic, high-mountain, arid (desert) and tropical climates. The formation of an adaptive type also includes the development of specific anatomo-physiological mechanisms that ensure the optimal use of food resources provided by the ecological and climatic niche.

One of them is centuries of adaptation to varying diets in representatives of various adaptive types. This adaptation has resulted in the emergence of unique variations of gastric digestion in members of particular groups.

The majority of human populations are characterised by digestion of the so-called boar type. This type of digestion is most expressed in omnivorous mammals (bear, wild boar), which eat meat together with plant food.

The indigenous people of the Arctic, whose diet contains a very high amount of proteins and fats, have a wolf-like stomach digestion, similar to that of predators.

In certain cases, adaptation can be very specific. For example, members of some indigenous groups in New Guinea have a permanent nitrogen-fixing microflora in their intestines. The periodic digestion of nitrogen-fixing bacteria can supply the body with additional nitrogen, which is lacking in foods poor in protein and amino acids.

Cultural and economic adaptation leads to the formation of specific subsistence systems - ecologically linked forms of social behaviour that ensure the existence of a community of people using the resources of a particular living environment.

The efficiency of different subsistence systems can be evaluated by comparing the energy value of the products obtained by a group of people from their economic territory with the amounts of solar energy obtained in the same territory.

The efficiency of subsistence systems operating in similar climatic and geographical regions can differ by hundreds or even thousands of times.

The subsistence system is an interconnected set of features of production activities, demographic structure and settlement, labour cooperation, consumption traditions and the appropriation of "welfare".

The elements of this complex are interrelated. For instance, a lack of environmental resources can lead to traditional elimination of "extra mouths to feed" (relocation of members of a gender, age or social group; direct elimination - killing newborns or the elderly); expansion of the diet to include new types of food (cannibalism is an extreme example); and tighter distribution of resources within the group.

All cultures need methods of generating products and distributing them for consumption. This is the core of the economic system. The forms they take vary around the world. Many involve working from home or with a corporation. Some economic systems maintain the independence of families, while others lead to greater, though often unrecognised, interdependence. Generally speaking, many anthropologists think of economics in terms of reciprocity, market exchange, and redistribution.

The manner in which food and other material items are produced is called the production system. In particular, the way in which a group produces its food is called a subsistence strategy or mode of subsistence.

Four main modes of subsistence that have been used throughout human history are: foraging, pastoralism, horticulture, and agriculture. Each of these modes involves different strategies for producing, exchanging, and consuming the things that humans require for survival. The most fundamental level is the basic needs of food, clothing, shelter, and health.

Modes of subsistence provide decisions to satisfy these needs by producing materials from the environment and developing methods of labour and forms of technology to process these materials. In addition to these very important functions, modes of subsistence also organise societies to do the necessary work. Societies design roles, groups, and institutions to share the workload of production of things. Modes of subsistence also involve certain ways of trading and circulating things inside and outside local groups. Finally, ways of being also emphasise certain ideals and values.

As each mode of existence is adapted to specific environmental conditions, we can view each culture's subsistence system as an adaptation or collection of survival strategies specifically designed to fit a particular environment. Since culture shapes the way we view and interact with the surrounding environment, different societies can adjust to the exact same environment in different ways.

Foraging, which is sometimes known as hunting and gathering, describes societies that primarily rely on "wild" plant and animal foods resources. Pastoralism is a subsistence system in which people keep livestock herds. Horticulture is the small-scale cultivation of crops primarily for subsistence. Agriculture entails the cultivation of domesticated plants and animals by using technology to intensively use the land.

Recognising that the Earth has been transformed over millennia by human activity, we should also consider how our future will be governed by the present. Are we operating our resources in a sustainable manner? How will we continue to feed a rising population in the future? Think about this the next time you sit at the dinner table.

Self-control questions to Topic 3:

1. The environment is strongly linked to the concept of adaptation, isn't it?

2. Since the existence of human, his health has been formed and continues to be formed under the influence of … factors. (fill in the omitted word)

3. From the very beginning, all living organisms adapted to the earth's living conditions such as:

a) gravity;

b) weightlessness;

c) radiation;

d) deep dives.

4. Social stressors include:

a) highland conditions;

b) gravity changes;

c) hypodynamia;

d) high noise.

5. Social factors of human adaptation. How have conditions of human production changed in the process of development of society? And what are the consequences for the human body it can lead to?

6. Adaptation at the level of cells and tissues of the body – it is:

a) genetic adaptation;

b) biochemical adaptation;

c) physiological adaptation;

d) morphological adaptation.

7. Groups of adaptation processes:

1. mutational adaptation	*A. direct human adaptation to rapidly changing environmental conditions*
2. modification adaptation	*B. the evolution of a population, which culminated in the creation and formation of races*
3. modulation adaptation	*C. the process of human acclimatization to changes in environmental conditions*

8. Modern species of living organisms have been formed on the basis of heredity, mutations and natural selection as a result of:

a) modification adaptation;

b) genotypic adaptation;

c) physiological adaptation;

d) modulation adaptation;

9. The active adaptation of the organism to one factor doesn't improve its resistance to complex of other factors. (yes or no)

10. Various representatives of the plant and animal kingdoms (including humans) most often use:

a) an active strategy for adapting to changes in the conditions of existence;

b) a passive strategy for adapting to changes in the conditions of existence.

11. The most important component of human energy consumption is basic metabolism, isn't it?

12. Variants of gastric digestion from members of certain groups of human populations:

1. digestion by the wild boar type	*A. indigenous populations of the Arctic, whose diet contains a very large amount of protein and fat*
2. digestion like a wolf	*B. this option is most pronounced in omnivorous mammals, which eat meat along with plant foods*
3. digestion of nitrogen-fixing bacteria	*C. this type of digestion can provide the body with additional nitrogen, which is lacking in food poor in proteins and amino acids*

13. Different strategies of energy conservation and its replenishment (nutrition) are based on long-term adaptations to their habitat:

a) biological way (formation of adaptive types)

b) cultural and economic ways (formation of different subsistence systems)

c) all the above answers are correct

14. The concept of subsistence systems. How the efficiency of different subsistence systems could be assessed?

Section 4.
HUMANS AS THE MAIN SUBJECT OF BIOSPHERIC CHANGE

4.1 Human evolution

The evolution of life on the planet is the evolution of the entire biosphere as a united (indivisible) system.

Moreover, the evolution of life on the planet occurs simultaneously with the transformation of biogenic habitat. Thus, the evolution of the biosphere is considered as an integrated system, which includes not only the biota but also bio-inert and inert matter in terms of Vernadsky, as well as ecosystem, landscape, and the whole global planetary structure.

Life as an active and most dynamic component of the biosphere permeates the entire environment. It gradually transforms environment and thereby changes the conditions of its own existence.

That is, biosphere is a planetary, global expression of life activity and from the other side it is the only favorable milieu for durable existence of biota. Any living organism has relatively autonomous organization of metabolic processes and at the same time, all living creatures are fundamentally dependent on each other via trophic, behavioral, sexual relationships.

Any organism is the element of many systems – group (family, flock, school, population, etc.), community, ecosystem and biosphere as a global planetary system. All organisms are included in local and global biogeochemical cycles.

Systemic status of biosphere and mechanisms of its development (or evolution) are still debatable questions. The question "what is the origin of life: either origin of organisms or origin of biosphere?" is not correct because only whole biosphere is independent unit of life among all known living forms.

Many scientists suggest that the phenomenon of life isn’t connected only with life of separated organisms; they believe following Vernadsky that life without

biosphere is impossible and doesn't exist and the planetary influence of living matter becomes more extensive with time.

Homo sapiens, appeared at the end of Phanerozoic eon, began to use for their needs fossil raw materials and energy sources inaccessible to other organisms (e.g. fire, nuclear energy). They continued general tendency of intensification of energy flow and biogenous cycles in the biosphere evolution.

Humans' extremely rapid spreading across the planet and increasing role in biosphere processes is obliged first of all to the fact that they use language for communication and transmission of information about their technological discoveries. Biological evolution has ceased to play a crucial role in their survival on Earth.

Contemporary science considers the human being on the basis of two different dimensions of his existence: the biological and the social. Human beings appeared on earth as a result of a long process of development. As biological creatures, they still retain a close genetic connection with the animal world. Man's organism has many features in common with the higher animals.

Human evolution is the evolutionary process leading up to the appearance of modern humans. While it began with the last common ancestor of all life, the topic usually covers only the evolutionary history of primates, in particular the genus *Homo*, and the emergence of *Homo sapiens* as a distinct species of hominids (or "great apes").

The study of human evolution involves many scientific disciplines, including physical anthropology, primatology, archaeology, ethology, linguistics, evolutionary psychology, embryology and genetics.

Genetic studies show that primates diverged from other mammals about 85 million years ago in the Late Cretaceous period, and the earliest fossils appear in the Paleocene, around 55 million years ago.

The earliest documented members of the genus *Homo* are *Homo habilis* which evolved around 2.3 million years ago; the earliest species for which there is positive

evidence of use of stone tools. The brains of these early hominids were about the same size as that of a chimpanzee.

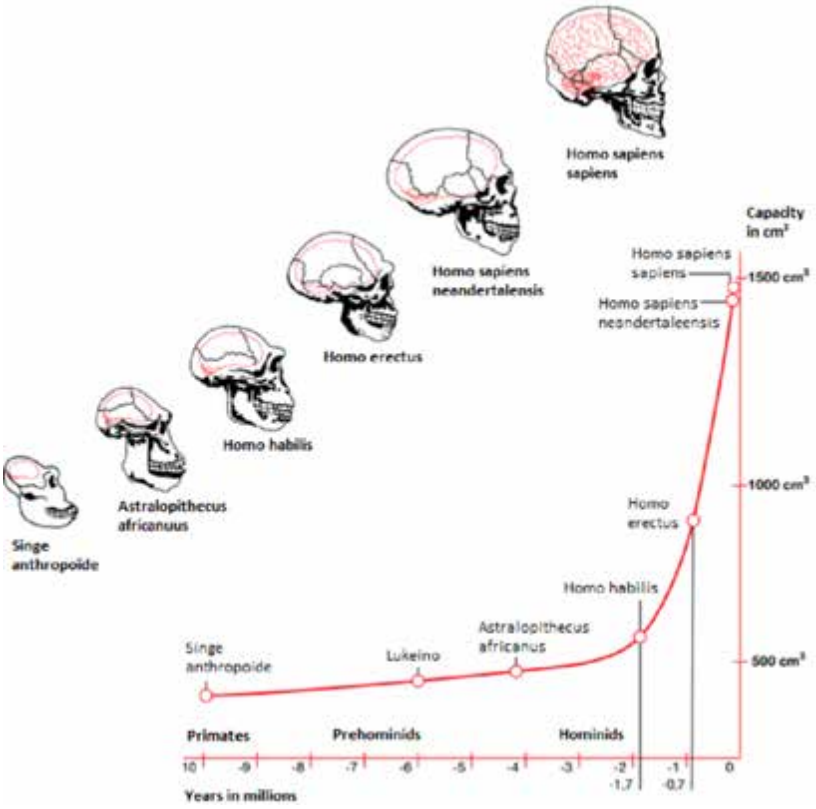


Figure 4.1. Human evolution based on skull endocasts of fossil archaic primates and early hominids

During the next million years a process of encephalization began, and with the arrival of Homo erectus in the fossil record, cranial capacity had doubled to 850 cm^3. *Homo erectus* and *Homo ergaster* were the first of the hominine to leave Africa, and these species spread through Africa, Asia, and Europe between 1.3 to 1.8 million years ago.

It is believed that these species were the first to use fire and complex tools. According to the Recent African Ancestry theory, modern humans evolved in Africa possibly from *Homo heidelbergensis*, *Homo rhodesiensis* or *Homo antecessor* and

migrated out of the continent some 50,000 to 100,000 years ago, replacing local populations of *Homo erectus* and *Homo neanderthalensis*.

Archaic *Homo sapiens*, the forerunner of anatomically modern humans, evolved between 400,000 and 250,000 years ago. Anatomically modern humans evolved from archaic *Homo sapiens* in the Middle Paleolithic, about 200,000 years ago.

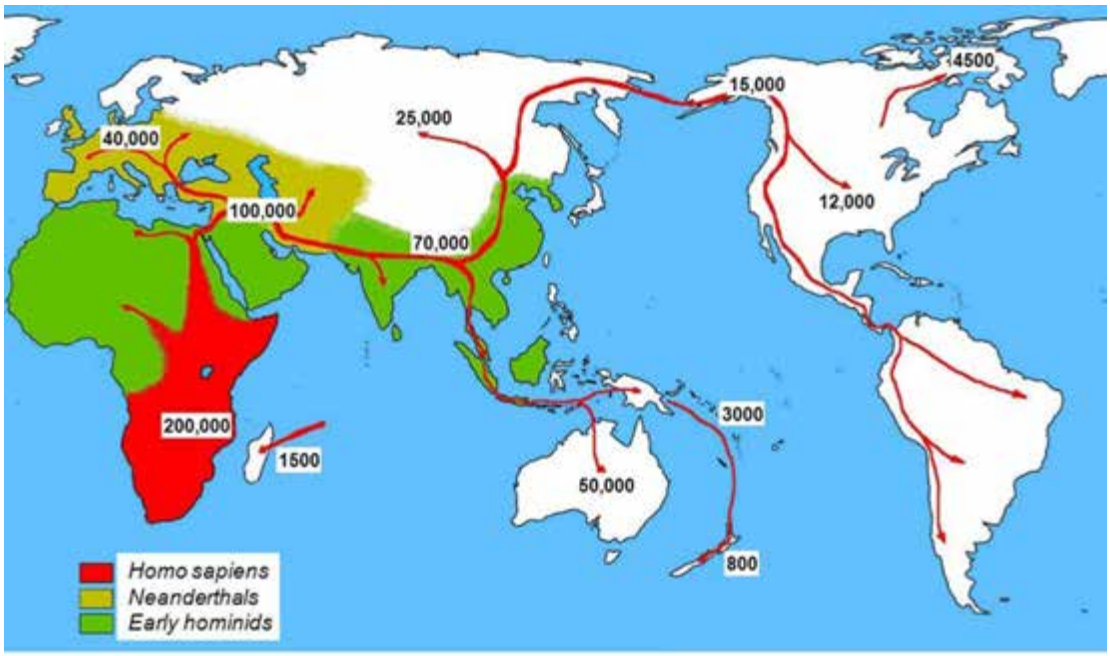


Figure 4.2. Modern humans colonize the globe

The transition to behavioral modernity with the development of symbolic culture, language, and specialized lithic technology (in archaeology, lithic technology includes a broad array of techniques used to produce usable tools from various types of stone) happened around 50,000 years ago according to many anthropologists although some suggest a gradual change in behavior over a longer time span.

And today humans are continuing to evolve, but now the evolution is driven as much by our culture and the technology we've invented as by our biology. And other animals, including the apes, are also continuing to evolve − especially now, in response to the huge changes in their environment that humans have made.

4.2 Human as a natural and social being

The problem of the relationship between social and biological includes the most important issues of the development of the biosphere of our planet, the spontaneous and rational regularization of relations between human and nature, genetic and life development of human, the consequences of urbanization and industrialization, which directly or indirectly affect human health.

All this is the basis of human theory and is subject to analysis and integration in terms of internal unity, interconnection and contradictions of social and biological in human being in the context of its health problems.

Considering the problem of human, we must always take into account both the factor of heredity and the role of the environment under the influence of which human is formed as a natural-social being.

From parents we inherit not only the peculiarities of ancestry, but also some general social characteristics. In addition, we are a part of nature and learn to live in harmony with both our own nature and the environment. Next to us are friends, acquaintances and strangers who make up society. So, human has his own habitat − natural and social.

The concept of the natural environment is not limited to the sphere of the Earth, it includes space in general.

There is a hypothesis that states that life on Earth arose under the influence of cosmic processes. It is therefore only natural that any living organism in some way interacts with space. Solar storms and associated electromagnetic disturbances affect cells, the nervous system, blood vessels, human well-being and psyche. We live "in unison" with the entire cosmic environment and any changes in it affect our state of being.

The ideas of K.E. Tsiolkovsky, V.I. Vernadsky and A.L. Chizhevsky that we are surrounded on all sides by streams of cosmic energy that comes to us through a huge distance from the stars, planets and the Sun.

Human exists in the system of interaction of all the forces of nature and feels all its various influences. His mental balance is possible only under the condition of physiological and mental adaptation to the natural world.

But human, as a biological being, cannot exist without communication with nature, just as human as a social being cannot exist without society. Both social and natural factors act ruthlessly in this sense.

The formation of human in all its diversity is due to the assimilation of the values developed by humankind throughout history. This is the language, different ways of working as well as ability to use different tools.

Therefore, a child can become a fully human only by living in society, communicating and interacting with other people, learning from them.

Neither Kamala nor Amala who have spent their childhood among wolves, nor six-year-old John who was found among monkeys in Africa, haven't been able to learn to talk.

In 1920, in India two girls named Amala twelve and Kamala eight years old were captured by a reverend named Joseph Singh in a wolves' den. These girls also known "The Wolf Girls" & it is one of the famous case of feral children. The girls were raised by wolves. When first time, Singh captured the girls they ran on all fours, didn't look. Singh claimed they preferred to eat raw meat and howl like a wolf. Their sense of smell, hearing and sight was exceptional. Singh tried his best to learn them manners and taught to speak in this case he got limited success. Soon Amala was died while Kamala learned few words to speak and walk upright. But in 1929 at age of seventeen, Kamala died due to the failure of her kidney.

Six-year-old John Ssebunya was found living with green vervet monkeys in the Ugandan jungle in 1991. He is believed to have run away from home when he was 3 years old after seeing his father murder his mother.

Heredity and variability. In the process of individual human development, on the one hand, he implements a genetic program and reproduces certain traits passed on to him by his parents (the set of such psycho-physiological qualities is called

potentialities: ear for music, visual memory, strong constitution, ability to distinguish colours, sense of rhythm, etc.).

On the other hand, human acquires new features that contribute to human evolution.

The potentialities of man are the basis of his abilities. However, whether the potentialities will be realized and whether they will develop in the ability depends both on the conditions in which a person develops and on our own efforts.

The main thing is to believe in your own strength and persistently strive to achieve your goal!

But the question of what factors play a decisive role in the formation of human being has not only cognitive but also vital and practical significance. One way or another, people's attitudes to the world around them and to themselves depends on the answer to this question.

The exaggeration of the role of heredity leads to the conclusion that all our good and bad traits depend only on our parents, whom of course we do not choose.

Such an approach is due to the underestimation of the conditions of the environment in which we live, so, they say, the efforts of society, as well as our own, to improve the human being are in vain.

But the influence of society on human development is very large.

Especially in childhood, when it is extremely important what kind of relationship has developed in the family. And you, as prospective parents, also need to keep this in mind.

It should be noted that the impact on a person of the social environment can be both spontaneous, accidental, and conscious and purposeful. Such an impact is called education.

Education is to some extent also self-education, that is, a person's own efforts to shape or improve himself.

4.3 Human Uniqueness

And yet, why has human become the "master" of the biosphere? As a member of the Hominidae family, humans had some favorable characteristics that ensured their biological dominance in the biosphere.

The English scientist Robert Foley identifies the following characteristics:

1. A higher degree of reproductive success.
2. The presence of speech.
3. An unprecedented behavior flexibility.
4. Straightened position of the body.
5. The brain is too complex for the purpose of comfort.
6. Advanced technological skills.

All of these features indicate a human uniqueness that has been formed because of two factors, namely:

1) belonging of humans to the class of mammals;

2) habitat - terrestrial area, a land-based existence.

According to R. Foley, uniqueness becomes a problem when we try to relate a unique phenomenon to a general class of phenomena and then seek to explain the nature of the variability detected for this class on the basis of general principles and regularities.

To understand the uniqueness of humans, it is necessary to compare Homo sapiens with its closest relatives, the great apes. The physiological basis of this kinship was demonstrated long ago by Darwin (1871) and Haeckel (1863). Genetic differences are surprisingly small at less than 1%, but behavioral differences are significant.

There are many versions explaining this difference. These include the special conditions of anthropogenesis in East Africa, and the hypothesis of A. Koestler (USA), who argued that intelligence is not healthy, and that Homo sapiens is the victim of a small error of design, most likely a miscalculation in the organization of

the nervous system, which instills in man a tendency toward manic ideas and pushes him toward self-destruction.

The evolutionary biologist Theodosius Dobzhansky once said, “All species are unique, but humans are uniquest.” Humans have long taken pride in their specialness.

Stanford Biology professor Robert Sapolsky believes that human beings feel that they are unique, unlike other species. But this has been questioned by studies that have been done on other primates.

As Sapolsky says, we still have established ourselves as the best, the untouchable, the incomparable dream team of the animal kingdom, forgetting how un-special we truly are.

As he says in his famous lecture “The uniqueness of humans” (2009) almost all of the things that we used to think made us humans unique in the wild kingdom can in fact be observed in other species. According to Sapolsky, it is:

- ✓ Intra-species aggression (including genocide);
- ✓ Theory of Mind;
- ✓ The Golden Rule;
- ✓ Empathy;
- ✓ Pleasure in anticipation & gratification-postponement;
- ✓ Culture.

But, for example, if you assume that humans are far superior than other species because our genetic codes are far more intricate and advanced, you’re wrong. To use Sapolsky’s word, our genetic makeup is not much uniqueier than that of a fruit fly’s.

Also, other species invent tools and use them with dexterity and local cultural variation. Other primates display “semanticity” (the use of symbols to refer to objects and actions) in their communication in ways that would impress any linguist. And experiments have shown other primates to possess a “theory of mind,” that is, the ability to recognize that different individuals can have different thoughts and knowledge.

Our purported uniqueness has been challenged most, however, with regard to our social life. Like the occasional human hermit, there are a few primates that are typically asocial (such as the orangutan). Apart from those, however, it turns out that one cannot understand a primate in isolation from its social group. Across the 150 or so species of primates, the larger the average social group, the larger the cortex relative to the rest of the brain.

The fanciest part of the primate brain, in other words, seems to have been sculpted by evolution to enable us to gossip and groom, cooperate and cheat, and obsess about who is mating with whom. Humans, in short, are yet another primate with an intense and rich social life—a fact that raises the question of whether primatology can teach us something about a rather important part of human sociality, war and peace.

Culture is very typically thought of as inherently human and only human. After all, anthropologist E.B. Tylor defined culture as that complex whole acquired by "Man." The definition of culture as shared traditions, beliefs, and values that are transmitted through learning allows us to ask whether humans are the only cultural species. With this definition of culture, we can ask whether non-human animals have anything that resembles learned behaviors.

For many anthropologists, culture is not just about learned traditions, but rather the assignment of meaning and value to those traditions. We pass along beliefs, values, stories, and social traditions that are loaded with meaning. Our beliefs are connected to how we interpret things or how we assign meaning to objects and behaviors.

Humans' ability to create and transmit new cultural trends has helped our species dominate Earth, in large part because each new generation can benefit from the experiences of the previous one. Researchers have found that similar, albeit much simpler, cultural transmission takes place in animals, including fish, insects, meerkats, birds, monkeys, and apes.

But, although Humans and other mammals are primarily made up of the same factors: same elements of the periodic table, relatively same genes same functional organs, but what really makes us special, unique and unprecedented is the “novel us[age]” of what we’re made of.

As Sapolsky has shown, other species have facilities (intra-species aggression, theory of Mind, the Golden Rule, empathy, pleasure in anticipation & gratification-postponement, culture) that we previously thought were unique to humans.

However, we humans exhibit these facilities with a twist – with an added layer of complexity.

Human biological evolution did not stop with the emergence of civilization, it continues, and the changes that have occurred in the human body, even since the ancient period, are very significant.

However, as mentioned above, human biological evolution has become obviously indirect and is determined by socio-technical factors rather than biological ones.

Thus, for example, human biological evolution now does not lead to the formation of new species of Homo sapiens, because through the use of technical means man creates an artificial environment of his habitat and thus overcomes the isolation of ecological niches as an important factor of speciation in the organic world.

The human being has become a universal creature. He can exist almost in any conditions of the Earth's surface and even begins to explore outer space. Thus, the problem of human biological specialization gets solved.

The very fact of ecological universality accounts for the absence of speciation in humans. Moreover, instead of speciation, the opposite tendency is observed in the development of humankind – species consolidation is increasing by overcoming racial diversity within the human species.

However, being the opposite direction of evolution in the organic world, this process is also one of the manifestations of the biological evolution of man, which

led him to the dominant position in the biosphere and made him the main subject of biospheric change.

To understand how it happened, it is necessary to turn to the problem of the relationship between society and nature in the history of civilization.

Self-control questions to Topic 4:

1. The evolution of life on the planet occurs simultaneously with the transformation of biogenic habitat. (*yes or no*)

2. Anatomically modern humans (Homo sapiens) appeared:

a) about 200 thousand years ago;

b) 100-150 thousand years ago;

c) 50-35 thousand years ago;

d) 0-10 thousand years ago.

3. Humans' extremely rapid spreading across the planet and increasing role in biosphere processes is obliged first of all to the fact that they use … for communication and transmission of information about their technological discoveries. *(fill in the omitted word)*

4. According to molecular genetic research, the ancestral home of human is:

a) Northern China;

b) South-eastern Europe;

c) Africa;

d) South Asia.

5. The main trends of hominization were:

a) walking upright;

b) increase in brain volume;

c) adaptation to work;

d) all the above factors.

6. Now the evolution is driven as much by our biology we've invented as by our culture and the technology. (*yes or no*)

7. Considering the problem of Human, we must always take into account both the factor of … and the role of the … under the influence of which human is formed as a natural-social being. (*fill in the omitted words*)

8. The values, developed by humankind throughout history, by which the formation of human has occurred:

a) language;

b) different ways of working;

c) sense of rhythm;

d) ability to use different tools;

e) self-confidence.

9. Potentialities are:

a) the conditions in which a person develops;

b) the set of psycho-physiological qualities inherited from a person's parents;

c) capacity to live in harmony with both our own nature and the environment.

10. Conscious and purposeful impact on a person of the social environment is called … (*fill in the omitted word*)

11. Among the favorable characteristics that ensure biological dominance of human beings in the biosphere were:

a) A higher degree of reproductive success;

b) Increased streams of cosmic energy;

c) An unprecedented behavior flexibility;

d) Advanced technological skills;

e) Autonomous organization of metabolic processes.

12. A human uniqueness has been formed because of two factors according to Robert Foley:

a) belonging of humans to the class of reptiles;

b) belonging of humans to the class of mammals;

c) *the habitat is on land;*

d) the habitat is aquatic environment.

13. What, according to R. Sapolsky, makes humans unique, despite their common abilities with primates?

14. Why didn't human evolution stop with the emergence of civilization?

15. What the opposite tendency instead of speciation is observed in the development of humankind?

Section 5.
HUMAN–ENVIRONMENT INTERACTIONS

5.1 The Evolution of Social Ecological Systems

As a species humans have relied on their capacity for sociality and communication in order to surpass their physical limitations. Their success as a species in spreading and colonizing the planet was through operating as relatively small groups of hunter-gatherers (HG).

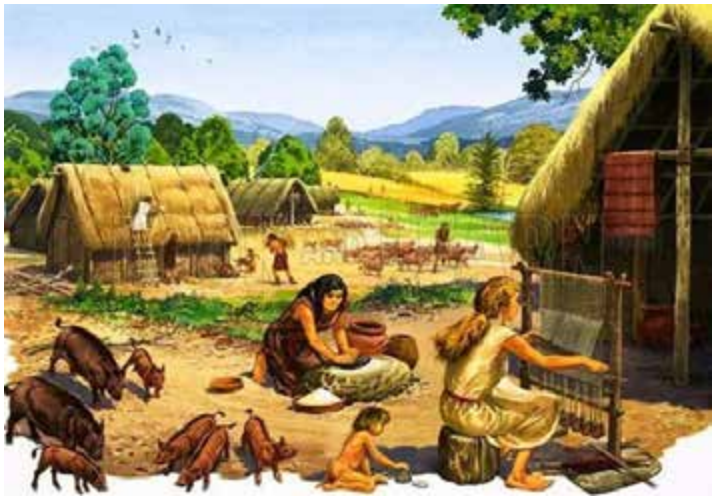
HGs' advantages were their behavioral flexibility, based on small-group trust and reciprocity, in response to opportunities and their highly mobile strategy of resource harvesting. This strategy served our species well for most of our time on the planet. However, as we grew in population size this strategy began to demonstrate its limitations in providing for an ever larger population.

Hunter-gatherers knew about plant reproduction and carried out light management of plants of interest to them long before they began to sedentarize and turn into farmers.

This first major transformation in social ecological systems, from hunter-gathering to farming, was a result of population increase, growing confrontation of HG bands over resources, and of rising costs and risks of moving into marginal environments. It took a couple of millennia for the transformation from a mostly HG landscape to one increasingly occupied by farming groups.

The greater density of farming communities allowed them to occupy preferred territories, and HGs increasingly were pushed into marginal areas which could not be cultivated. The keystone features of this new farming mode of production were

the evolution of community institutions, shifts in the scope of reciprocity and trust, domestication of plants and animals, and sedentarization.



The shift in reciprocity and trust led to features of social cooperation being associated at first with the settlement, and as settlements grew in size to kin-based groupings such as lineages, clans, and moieties.

In settled farming communities, control over land through inheritance grew over the years. In order to ensure control over the better land, and eventually over investments such as irrigation and homes, lineal descent through either father or mother came into play in order to provide clear forms of inheritance, along with the development of rules of preferred marriage, and even endogamy, to ensure control over resources.

The evolution towards kin-based lineal systems provided a more rigid form of passing on cultural values, identities, norms, and religious preferences. This process took hundreds of years to occur as groups developed their own combination of workable ways of controlling resources as a function of population density, competition, and resource availability.

Over time, as agriculture moved from extensive production systems to more intensive systems based on irrigation and eventual mechanization, social stratification, ethnicity, and complex rules for resource use and exclusion came into being.

Control over land becomes the greatest source of wealth, and by extension this provides greater control over labor, as more and more people are not able to control access to land – especially in patchy environments such as semi-arid landscapes.

A number of scientists have shown that the most important driver of the intensification implied by the shift from HG to agriculture has been population

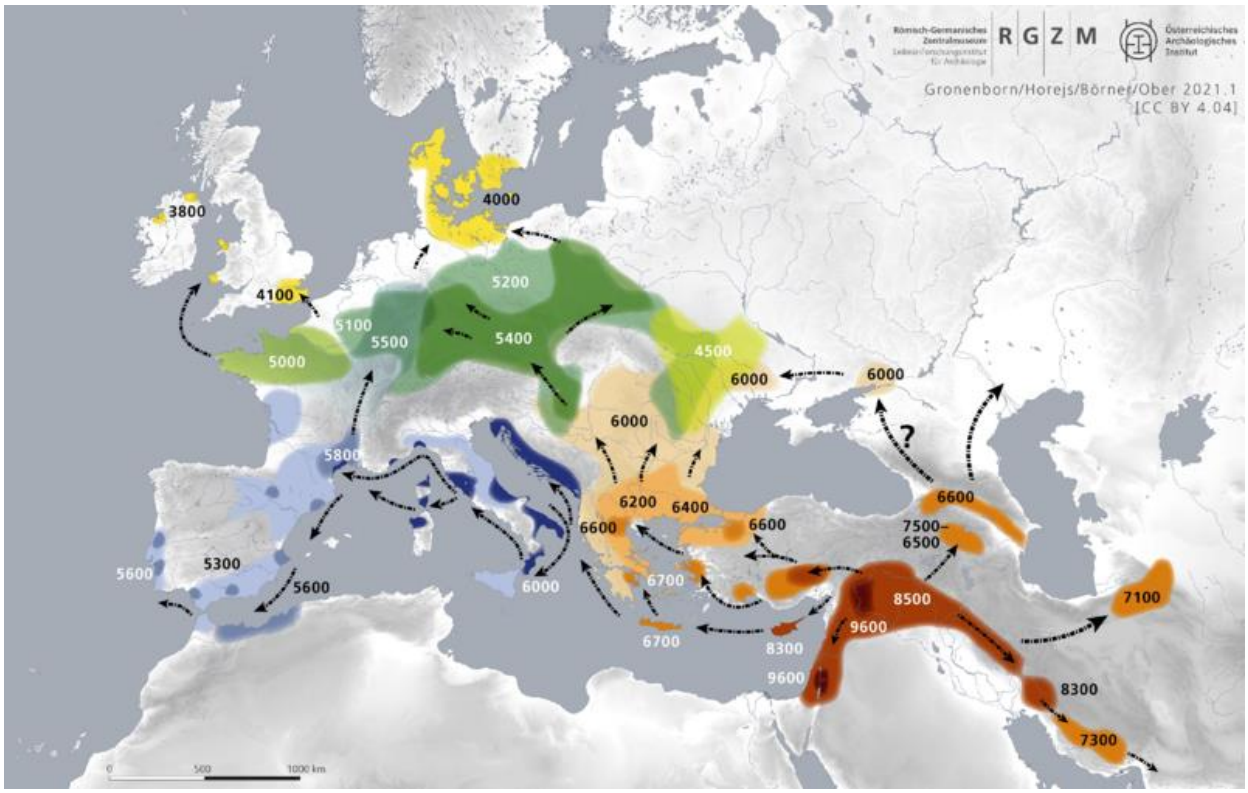


Figure 5.1. The spread of farming across western Eurasia, between 9600 and 3800 BCE

(Source: https://vividmaps.com/the-spread-of-agriculture-into-europe/)

growth leading to greater applications of technology to production in order to stave off famine and meet the basic needs of growing populations.

It is associated with greater competition over resources and the growing need to store supplies for times of scarce resources. The need to store provisions, rather than move to find them, resulted in a shift in how labor was invested, and in the settlement pattern of peoples worldwide.

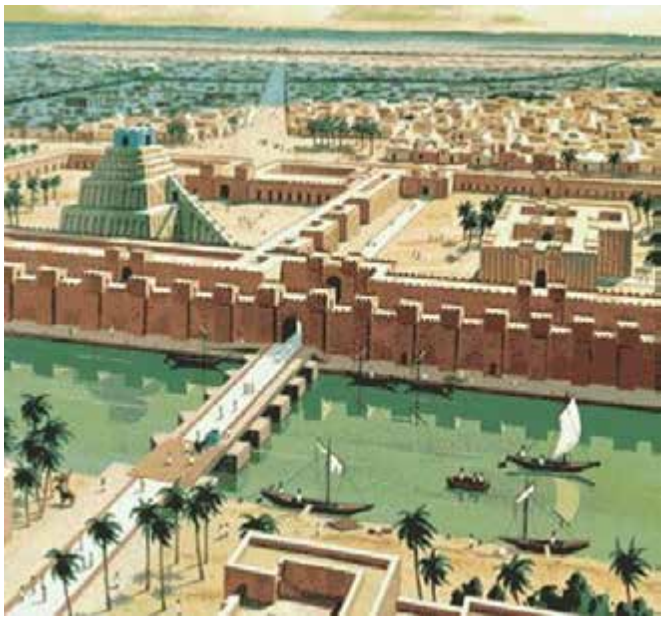
As these populations grew more numerous, chronic warfare ensued as groups competed for the best soils and the prime spots along the river or mountain, and sought ways to recruit more members to their communities.

Over time, some groups developed from single village communities into networks of communities, and chiefdoms emerged that provided some capacity to mobilize larger social units when any of their member communities was threatened.

The evidence is quite substantial that, as human communities grew more successful in production, the temptation was great for other communities to take away their accumulated wealth (often in the form of grain or animals). As in the shift from HG to extensive cultivation, the shift from extensive cultivation to intensive cultivation appears to have been driven by population growth putting too much pressure on resources.

Associated with farming populations one often found pastoralists, occupying land unsuitable for cultivation. Pastoralist social organization shows much greater flexibility than other forms of subsistence because of the flexible nature of managing animals.

It was just a matter of time, and opportunity, for people to have their growing villages develop into larger and more complex entities that we have come to call cities. Urban areas provided a site for trade, for the exchange of information, for specialists in a large number of skills to meet the needs of a more technologically intensive society, and for redefining the nature of social ecological interactions.



The rise of urban centers is most commonly associated with irrigation and the rise of complex water control. As these systems grew in size and complexity, breakdown became more common and more costly. In time, when they had grown to huge proportions, the systems could collapse when either information or climate, or both, were beyond the capacity of managers.

If the rise of cities and a growing network of linked villages into states proved to be a considerable source of disturbance in social ecological interactions, imagine

what happened with the rise of that technological wonder that is the industrial revolution.

Cities are symptomatic of human transformation of social ecological systems: they are creative centers where some of the best and brightest of every society are concentrated to develop the arts, technology, education, science, and commerce.

Yet, they are also often chaotic, with erosion of social controls, and distant enough from day-to-day realities of environment to ignore environmental feedbacks for a very long time. That is because urban areas have too many layers of information between the environment and the decisions managers take – who are motivated by many other incentives than just ensuring good environmental management: political pressures, mis-valuation of the resources, self-interest, and corruption.

The industrial mode of production is accompanied by major technical innovations that also result in a reorganization of the division of labor. The industrial revolution's larger environmental impact is the product of discovering ***the use of fossil fuels***.

First, and for a very long time, this involved only the use of coal. Oil and natural gas came much later. In using fossil fuels humans did not have to compete with any other animal species to use the resource, as we had often had to do with the use of plants (herbivores) and animals (carnivores). This would seem to be a win-win situation, and it certainly allowed for an enormous increase in the amount of energy that humans could harness for productive purposes.

Unfortunately, the exploitation of the huge amounts of fossil fuel materials stowed away for geologic periods of time in subterrestrial sinks and the launching of the by-products from their use into the biosphere, kicked off biogeochemical changes in the atmosphere that took a couple of centuries to be felt and which now threaten our planet.

But these changes were not entirely surprising. Local and regional consequences of the use of fossil fuels were felt early on: the nineteenth century fogs

of industrial cities like London, with serious health consequences for people living in these locations being the most recognized.

While the rich could escape to their rural estates to breathe fresh air, the poor in the cities grew sick from the constant exposure to foul air.

Social stratification, along with the use of police and power to maintain this mode of production with its high human and environmental costs, took place then and continues into the present, as developing countries industrialize with similar consequences.

The result has been a growing loss of trust and the virtual extinction of reciprocity except in the bosom of families, growing disparities between people in wealth and access to resources, an increase in the amount of time spent working, and a growing emphasis on consumption to support the productive capacity unleashed on the planet.

In short, over a period of 400 generations, or 10,000 years, the human population has grown from a few million to more than 7 billion. This growth has taken place quickly in recent decades, and has changed the nature of how we deal with each other.

The biggest shift has been since World War II and is connected to rising living standards and rising consumption levels for materials and energy. **This compounding of population and consumption is recent and without precedent**.

Human populations do not respond in homogeneous ways to the environment, or anything else.

Human society and culture are characterized by high diversity, and in the past this has gone along with biological diversity. The number of people who live by

hunting-gathering today is shrinking, and most of them are connected to the global economy to some degree.

Horticultural populations (i.e., extensive farmers using slash-and-burn methods mostly) still constitute significant populations in rural areas of developing countries – and among those in developed countries who seek to return our food production system to more organic methods.

The latter is a fast and expanding movement that questions the industrial mode of food production and seeks to return to more organic ways to take care of the land and produce the food we need.

Intensive farming is growing ever more intensive, now including genetic modification to a degree that has not been seen before. These shifts in the relationship of people to the environment constitute the fundamental questions that drive environmental social science and human–environment interactions research. With the growing recognition of the human dimensions of contemporary global environmental change this area of study has grown rapidly.

Many philosophers call the modern era the post-industrial (information) civilization. Its main feature is the transition to the dominance of the production of information, knowledge and the harmonization on this basis the relationship between humans and nature.

At the beginning of this new stage in the development of world civilization, a quite interesting concept of sustainable development appeared, the comprehension of V.I. Vernadsky's ideas about the noosphere continues.

The beginning of civilization was a turning point in human evolution. With increasing separation from the natural environment, mankind stimulated new adaptive reactions in response to new environmental factors.

It is generally accepted that the term “civilization” refers to any complex society characterized by urban development, social stratification, symbolic communication forms (typically represented by writing systems), and a perceived separation from and domination over the natural environment (Adams 1966).

From an evolutionary point of view, civilization started when humans, instead of reacting to the environment, began to actively shape it.

Since the Neolithic transition, mankind has experienced a shift to agriculture, domestication of animals and plants, sedentism, significant increase in population density, and exposure to new pathogens; most of these effects have been self-imposed.

Humans have been creating the artificial environment separating them from nature. This new environment induces new responses to it.

The development of civilization that began for us in the Fertile Crescent still continues today. The people of our civilization see the world as something that belongs to humans. Thus, they fan out across the globe seeking to subjugate the planet and exploit it for our material benefit.

5.2 The relationship between human and nature and problems of modern civilization

Until about the 1930s, the field of human activity coincided with the field of his immediate residence. What human perceived were mostly natural things, which he could see, hear, and feel with his senses. Human possessed the nature, fitting into it, but his activities left nature essentially intact.

Modern human knows much more than they can see, or at least imagine. They can plan and perform actions that they are no longer able to feel. And this changes their attitude to nature.

This relationship loses immediacy, becomes secondary, and is mediated by calculations and devices. It loses its clarity, becomes abstract and formal.

Nature is increasingly becoming a confusing system of relations and functions that only mathematics can comprehend. Science and technology have learned to use the energy of nature and human himself on such a scale that indicates the onset of a new stage in the history of civilization.

Human is forced to live side by side with the danger that is constantly growing and threatening him. Hence the desire to regain "naturalness", " harmony with nature" in the way of life and treatment of diseases, in upbringing and education, etc.

But it is impossible to go back. Hence, a new living space is needed for human who is aware of the meaning of his life and the ability to have a future. V.I. Vernadsky predicted that humanity would have to overcome an extremely difficult frontier – to learn a way of behaving that would stop the impending catastrophe and stimulate further progress.

Today, more than ever, there is a clear necessity for a new "environmental morality," a new vision of the world for every person living on Earth. The new attitude towards nature grows out of the awareness that humanity has reached the last limit, and requires vigilance and responsibility − things that are closely related to the problems of the "Ego" identity in human.

In the past centuries, economic considerations have forced people to shy away from the problems associated with unhealthy industries and products.

Even today, the demands of economic growth sometimes overshadow the problems of environmental pollution in underdeveloped countries. Therefore, it is not surprising that only in the recent past there has been an increase in the level of environmental awareness, which is associated with a number of events that have drawn our attention to the danger that threatens the planet.

It is known that the progressive economic developing of nature and the accompanying numerous violations of the natural balance have become a source of civilizational problems, which today are called environmental. In the initial stages of civilization, they were local and did not significantly affect the stability of the biosphere.

During the formation of man-made civilization, according to the figurative conclusion of V.I. Vernadsky, "*humanity is becoming a powerful geological force*" that transforms the natural landscapes of the Earth. The transition to the industrial-informational stage of development in the second half of the twentieth century was

characterized by an unprecedented growth in production, technology, agriculture, and the basic and applied sciences. Humans began to conquer outer space, created various weapons, learned to use the energy of the atom.

The growth of the planet's population as well as the powerful anthropogenic impact on the geosphere and uncontrolled technical development has exacerbated economic problems. For the past seventy years, civilization has been in a state of permanent ecological crisis that has put the biosphere on the brink of extinction.

All problems of civilization have become global (universal), the development of civilization approached critical limits, the limits of the growth of its quantitative indicators were clearly marked, and destructive processes became irreversible.

Today, the world has finally formed the idea that increasing the level of consumption is a destructive way of civilization.

With this in mind, the international community is creating organizations that are designed to define a strategy for solving global problems at the international level through international cooperation, implement practical measures aimed at protecting the environment.

5.3 Background of the modern global crisis of the system "Nature-Society"

The global biospheric crisis is a current state of sustainable disturbance of the dynamic balance between society's needs and the biosphere's resource capabilities, which leads to degradation of the natural environment and may result in a violation of human beings' ability to meet their basic (natural) needs.

Many reputable international NGOs and well-known scientists have tried to identify global problems of modernity. For example, M. Mesarovic in one of his presentations (Hannover, 1989) named five most important, in his opinion, tasks of humankind:

- decreasing the growth rate of the world's population;
- reducing the use of non-renewable resources;

- reducing the level of pollution and environmental destruction;
- shortening social and economic inequality between people and countries;
- ending hunger and extreme poverty.

In doing so, he emphasised that it was important not just to state and describe these problems, but also to answer how to overcome them and what means should be used to do so.


Konrad Lorenz

Nobel Laureate Konrad Lorenz (1903 - 1989) formulated 8 prevalent problem processes or "deadly sins" that are threatening humanity.

K. Lorenz, like M. Mesarovich and many other scientists, considers ***overpopulation*** to be one of the main sins of humanity. Overcrowding forces people to shield themselves from excessive social contacts and arouses aggression because of the crowding in a limited space.

The second cardinal sin of mankind is ***the exhaustion of natural living environment***. Talking about the depletion of the natural environment, K. Lorenz highlights that the main result of this is the destruction of human reverence for the beauty and majesty of nature, which is becoming an environmental and ethical problem for humanity.

The degradation of the natural environment is primarily due to ***the accelerated technological development***, and this is the third sin of humankind, which also has a negative impact on people because it changes their priorities and makes them blind to all real values. These days, for more and more people, television or personal computers are totally replacing people's communication, the natural world and the world of art.

Scientific and technological progress contributes significantly to the fourth sin of contemporary society - ***the dulling and disappearance of all intense human feelings and emotions***. At the same time, man's intolerance to everything that causes

the least displeasure is constantly growing, which modern man is increasingly neutralising technically or pharmacologically.

Permanent mindless use of pharmacology and degradation of the natural environment contribute to the emergence of the fifth sin - ***human genetic degradation*** - the increase in physical and mental pathology, which is registered in newborn children. The number of anomalies is increasing every year (approximately 10% of the number of births), especially in large cities and ecologically unfavourable regions.

The sixth cardinal sin of humanity is ***breaking with traditions***. Traditions are cultural norms that are determined by people's experience. By rejecting this experience as conservative, not corresponding to the present day, people are breaking with traditions. That is why the youth begin to treat their elders as a foreign ethnos, experiencing "national hatred". This trend undoubtedly takes place, and its main reason is insufficient contact between parents and their children.

According to C. Lorenz, extremely dangerous for society is the seventh sin - ***the growing ideological processing of mankind***, determined by the growing number of people of different nations belonging to the one cultural group, as a result of the increasing influence of technical means on public opinion. Such unification of views of people of modern society is caused by zombification of public opinion, continuous pressure of advertising, fashion, official political and social propaganda, skilfully aimed at unification of people's views.

Nuclear weapons are the eighth major sin, causing dangers that are no easier to avoid than the previous seven. At the same time, the entire international community is trying its best to prevent the proliferation of nuclear weapons, in particular, there are multilateral conventions, and new versions of international agreements are being sought and improved.

Because all global problems are socio-ecological in character, they are both the consequence of contradictions between human beings and society and between humans and the environment.

Typically, global problems are classified into three main groups.

Firstly, these are inter-social problems, that is, a set of issues that are arising in the global community between different entities (continents, groups of countries, or separate countries) on the basis of their economic, political or ideological differences. These problems undoubtedly include the risk of thermonuclear war, war conflicts, international terrorism, and so on.

The second are the problems of system "society-biosphere", which are created on the basis of uncontrolled or inadequately thought-out appropriation of nature's wealth by society and humans. This type of problem is exemplified by all environmental problems (or rather, "ecological" or ecological problems) of modern human and social development (pollution and degradation of the atmosphere, hydrosphere and space, as well as energy and raw materials, etc.).

Finally, there are the problems of the man-society system - the conflict between the real social life of an individual at the modern stage of functioning and development of society. These are aloneness, fear, estrangement and many other states that arise in human life in practically every society.

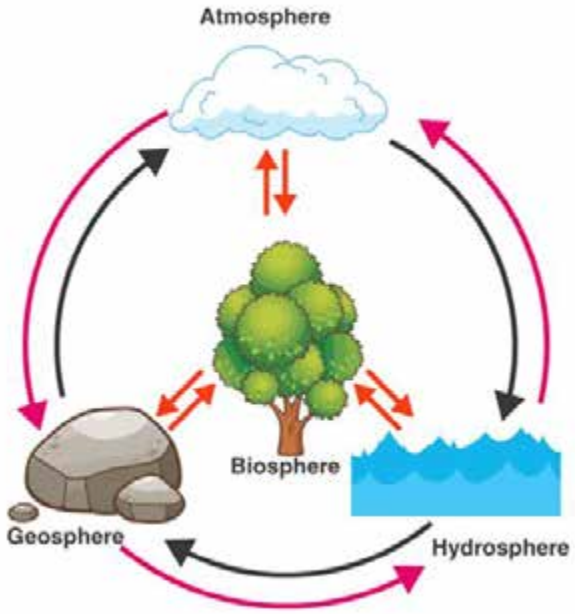
Although global problems are not easily distinguishable, this classification helps us to see not only their interconnection and interdependence, but also some general causes and circumstances of their emergence.

Modern global problems significantly change our view of evolutionary processes occurring in the world. Evolution changes humans, but humans also influence evolution, changing its nature and the way it flows. At the same time, the responsibility for the evolution of the world lies mainly with humans themselves.

It is impossible to consider global problems themselves within the framework of any one, even specialised, area of knowledge. This is due to the fact that global problems require simultaneous consideration both at the level of the biosphere, the technosphere and the sociosphere. Humanity's efforts will be effective only if none of the levels is missed and all of them are given proper attention.

5.4 Threats to the balance in nature by human activities

Rapid development activities have been associated with more and more exploitation of various natural resources. Technological development has resulted in fast depletion of non-renewable energy resources, mainly coal and petroleum, and also various minerals. Mining activities, dam, building, urbanisation and industrialisation have all interfered with the ecological balance of nature due to large scale impacts.



Dynamic interactions occur between the biotic region (biosphere) and the abiotic regions (atmosphere, lithosphere and hydrosphere) of the earth. Energy, water, gases and nutrients are exchanged between the regions on various spatial and time scales. Such exchanges depend upon, and can be altered by, the environments of the regions.

For example, the chemical processes of early life on earth (e.g. photosynthesis, respiration, carbonate formation) transformed the reducing ancient atmosphere into the oxidizing (free oxygen) environment of today.

The interactive processes between the biosphere and the abiotic regions work to maintain a kind of planetary equilibrium. These processes, as well as those that might disrupt this equilibrium, involve a range of scientific and socioeconomic issues.

The Earth system has several interacting constituents in delicate balance. A slight disturbance in this balance may bring a big threat to the entire life.

The Earth system has several interacting constituents in delicate balance. A slight disturbance in this balance may bring a big threat to the entire life.

These processes, as well as those that might disrupt this equilibrium, involve a range of scientific and socioeconomic issues.

Let us consider some of the human activities which are disturbing the balance in nature at an alarming rate.

Examples of threats to the balance in nature by human activities:

1) In our craze for comfort and zeal for industrialization we are burning fossil fuels at a very fast rate. Thus, the carbon dioxide which was fixed for millions of years is being returned to the atmosphere in few hundred years. This is causing not only an energy crisis but also posing a threat of global warming.

2) The mindless use of chlorofluorocarbons (the chemicals we use as refrigerants and perfume sprays) are eating up our protective ozone layer creating a hole in it above Antarctica.

3) Deforestation for paper and wood is minimizing the effective use of available solar energy on Earth.

4) Creation of non-biodegradable materials like polyethylene is making the Earth barren and pausing threats for various life forms.

We must realise that Earth is a unique planet. Its life-support systems have evolved under very special circumstances. We must pay special attention to maintaining the balance between the various components of the Earth system so that life on this planet can flourish and develop.

Self-control questions to Topic 5:

1. Through what was the success of humans as a species in spreading and colonizing the planet?

2. Hunter-gatherer's advantages were:

a) their physical limitations;

b) their use of fossil fuels;

c) their behavioral flexibility.

3. As a result of what was the first major transformation in social ecological systems?

4. The keystone features of new farming mode of production were:

a) domestication of plants and animals;

b) environmental pollution;

c) creating the artificial environment;

d) sedentarization;

e) evolution of community institutions.

5. When did social stratification, ethnicity, and complex rules of resource use and alienation arise?

6. Why does the social organization of pastoralists show much more flexibility than other forms of subsistence?

7. Why are cities a symptom of human transformation of social ecological systems?

8. The industrial revolution's larger environmental impact is:

a) self-interest and corruption;

b) the product of discovering the use of fossil fuels;

c) irrigation and the rise of complex water control.

9. When did the unprecedented increase in population and consumption occur?

10. A fast and expanding movement that questions the industrial mode of food production is:

a) organic agriculture;

b) biological diversity;

c) industrial revolution.

11. When did civilization start from an evolutionary point of view?

12. Does development of civilization still continue today? If so, how can we describe the relationship between human and nature at the present stage?

13. According to V.I. Vernadsky, humanity began to play the role of the most powerful geological force on the planet:

a) in the period of scientific and technological revolution;

b) since Homo Sapiens have spreading across the planet;

c) during the formation of man-made civilization;

d) since the industrial revolution.

14. Define the global biosphere crisis.

15. List the most significant global problems of humankind.

16. What problems does Conrad Lorenz call "mortal sins"?

Section 6.
IMPACT OF SOCIO-ENVIRONMENTAL FACTORS ON HUMAN HEALTH

6.1 Human health as a comprehensive indicator of the state of human society

A comprehensive indicator of the state of human society is the level of health of people. The concept of "human health" is very capacious and covers biological, social, economic, scientific, ethical and other aspects.

Scientists are still debating the interpretation of this concept, which in modern conditions is becoming a fundamental problem not only of medicine but also of human ecology.

According to modern ideas, ***health*** is a natural state of an organism that is in complete equilibrium with the biosphere and is characterized by the absence of any pathological changes. According to the World Health Organization (WHO, 1948), “health is a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity”.

Given the above, most scientists attribute the following basic elements to health criteria:

- normal functioning of all systems and structures of the body;
- dynamic balance between human body and environment;
- human ability to perform basic social functions, to productive work;
- adaptability (ability to adapt) of human body to changing environmental conditions;
- absence of disease or any signs of disease;
- physical, spiritual, social well-being, harmonious development of physical and spiritual strengths.

Thus, the problem of human health is in the preservation and development of its mental, physiological and biological abilities, which will contribute to optimal working capacity, social employment and maximum life expectancy.

Table 6.1 Risk factors for the formation of human health

Spheres	Specific weight, %	Group of factors
Lifestyle (way of life, habit of life)	49 – 53	Smoking Alcohol consumption Drug use Unbalanced diet Working conditions Living conditions Stress, distress Adynamia, hypodynamia Instability of family life
Genetics	18 – 22	Predisposition to hereditary diseases
External environment, nature	17 – 20	Pollution of air, soil, water (chemical, carcinogenic, allergic substances) Sharp changes in atmospheric phenomena
Health care	8 – 10	Ineffectiveness of preventive measures Low quality of medical care Untimely medical care

From the table it is clear that health category is formed from three components: a way of life, an organism and environment.

To a large extent, depending on hereditary factors, health is the result of human interaction with their environment and is largely (49-53%) determined by human mode of life.

Way of life (habit of life) is a certain, historically determined type, type of life. Way of life is a biosocial category that integrates the idea of a certain type of human life and is characterized by his work, everyday life, form of satisfaction of material and spiritual needs, rules of individual and social behaviour.

In other words, the way of life is the "face" of the individual and at the same time − the reflection of the level of social progress.

A person's way of life is largely determined by social and environmental conditions, but at the same time it depends on the motives of human activity, the peculiarities of his psyche and the functional capabilities of the organism. This, in particular, explains the real variety of lifestyle options for different people.

Social conditions of human life are determined by the socio-political pattern and socio-economic structure. Social conditions are manifested through social factors: working conditions, conditions of rest, living conditions, food, housing, cultural needs, relationships.

Way of life includes three categories:

- standard of living;
- quality of life;
- lifestyle.

The standard of living is primarily an economic category that reflects the degree of satisfaction of material, spiritual and cultural needs of man. It is a quantitative side (national income, consumption funds, the size of real incomes, housing, and health care).

Quality of life is a degree of comfort in meeting human needs (mostly a social category). Quality of life, the degree to which an individual is healthy, comfortable, and able to participate in or enjoy life events.

Lifestyle characterizes the behavioural features of human life, i.e., the model that reflects the psychology and psychophysiology of the individual (socio-psychological category).

If we try to assess the role of each of the categories of mode of life in the formation of individual health, we can note that the first two are equipotential because they have a social character.

It is clear that human health will depend primarily on a lifestyle that is more personal and determined by historical and national traditions (mentality), as well as personal proclivities.

The most complete relationship between lifestyle and health is expressed in the concept of "healthy lifestyle" (or Healthy Living − HL).

According to WHO, “a healthy lifestyle is a way of living that lowers the risk of being seriously ill or dying early”.

A healthy lifestyle combines everything that contributes to the performance of professional, social and household functions in optimal health conditions and expresses the orientation of the individual in the direction of forming, maintaining and strengthening their health.

According to modern scientific research, the health of an individual is influenced by *three basic factors*: biology, behavior, and environment. When determining how to create changing in health, we know that changing an individual’s biology is not feasible and changing an individual’s behavior is challenging. This leaves addressing the environment in which an individual lives, works, learns, and plays. We know that where you live affects how you live.

Policy, systems, and environmental improvements is a way to modify the environment that defaults to the healthier choice for all which has more of an impact on the health of the population.

6.2 The impact of the natural environment on humans

Since the existence of human, his health has been formed and continues to be formed under the influence of environmental factors on the body.

Human has adapted to the environment in the process of evolution and cannot live without it, because it is common to his inner environment.

From the beginning of embryonic germination to the end of his life, human being is in contact with the components of the environment (air, water, soil, food, etc.). The vital activity of the organism is in a continuous dynamic relationship with environmental factors. This interaction should not disrupt the adaptive mechanisms of the human body.

Under the influence of various stimuli of the human internal and external environments unconditioned and conditioned reflexes in his body are created. They determine the maintenance of dynamic balance, which is based on the exchange of matter and energy between the organism and the environment.

Environmental factors must effectively affect health and ensure the normal course of all activities of human.

Human being, as a biological species, is a part of nature, and environmental factors affect his in the same way as any other species. Even in the absence of anthropogenic impact, human health depends on many abiotic and biotic factors. If the values of certain factors go beyond the optimum range, human's condition worsens as well as reduces his resistance to various diseases.

6.3 Abiotic factors

Abiotic factors that influenced humans in the past continue to influence today.

Space, helio- and geophysical factors. The influence of the sun on human health has been observed since ancient times. However, detailed research on this topic has only just begun in the XVIII - XIX centuries.

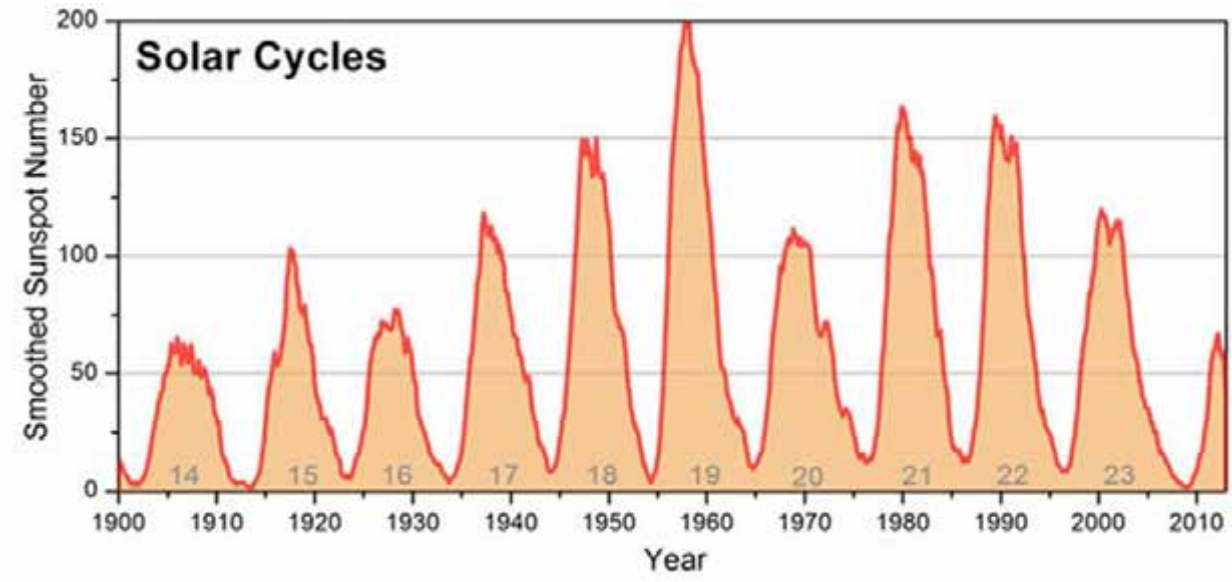


Figure 6.1. The Solar Cycle

Source: https://training.weather.gov/nwstc/spacewx/wmo/lesson2/solarcycle.html

Today it is known that the influence of the Sun is associated primarily with an 11-year cycle of solar activity, the increase of which causes perturbation of the magnetosphere and ionosphere. Such perturbations, in turn, cause an increase in the Earth's electromagnetic field strength, and this directly affects the body.

During the years of increased solar activity or when magnetic storms occur, there are more cases of disorders of the cardiovascular and nervous systems, mental and behavior disturbances. Bursts of solar activity lead, on the one hand, to a weakening of immune system and on the other hand - to increase the aggressiveness of pathogens and natural circulators of infections.

Thus, the probability of infectious diseases increases, including those that reach epidemic proportions, such as influenza, cholera, and dysentery.

Another factor is the level of ultraviolet (UV) radiation.

It determined the frequency of mutations throughout almost the entire history of the biosphere. In small doses, ultraviolet light is necessary for the evolution of the biosphere: mutations create genetic diversity in populations and therefore supply material for natural selection.

The Sun emits three types of ultraviolet (UV) radiation.

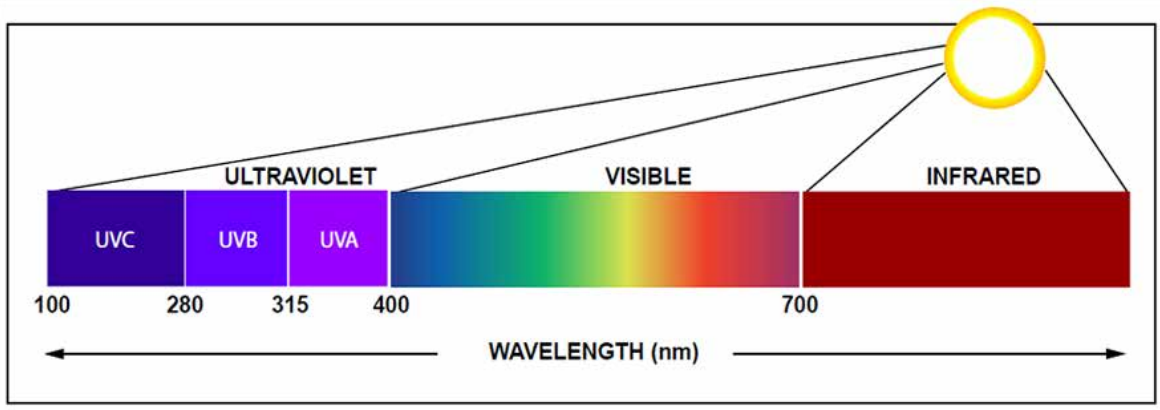


Figure 6.2. The light spectrum

Short-wavelength UVC is the most damaging type of UV radiation. However, it is completely filtered by the atmosphere and does not reach the earth's surface.

Medium-wavelength UVB is very biologically active but cannot penetrate beyond the superficial skin layers. It is responsible for delayed tanning and burning; in addition to these short-term effects it enhances skin ageing and significantly promotes the development of skin cancer. Most solar UVB is filtered by the atmosphere.

The relatively long-wavelength UVA accounts for approximately 95 per cent of the UV radiation reaching the Earth's surface. It can penetrate into the deeper layers of the skin and is responsible for the immediate tanning effect. Furthermore, it also contributes to skin ageing and wrinkling. For a long time it was thought that UVA could not cause any lasting damage. Recent studies strongly suggest that it may also enhance the development of skin cancers.

Ultraviolet in small doses is useful for humans: it has an antiseptic and bacteriostatic effect, prevents inflammatory processes in the hair follicles, and inhibits the development of pathogenic fungi that cause skin diseases − dermatomycoses.

In large doses, ultraviolet radiation is dangerous: it causes mostly harmful mutations (in particular, one beneficial mutation accounts for about a few thousand lethal mutations). Excessive radiation increases the probability of malignancies development - cancer, sarcoma, and leukaemia.

A thin ozone screen in the upper atmosphere protects living matter from the harmful effects of ultraviolet. Today, the existence of this screen is under threat. Therefore, ultraviolet radiation tends to see as a factor, hazard level of which depends on the human.

Climatic and meteorological factors. Among these factors, human is most affected by temperature, relative humidity and atmospheric pressure. Climatic factors are closely related to the functional state and defensive mechanisms in the body, as well as behavior motivation. This, in turn, determines the risk of occurrence of a number of diseases, including mental disorders.

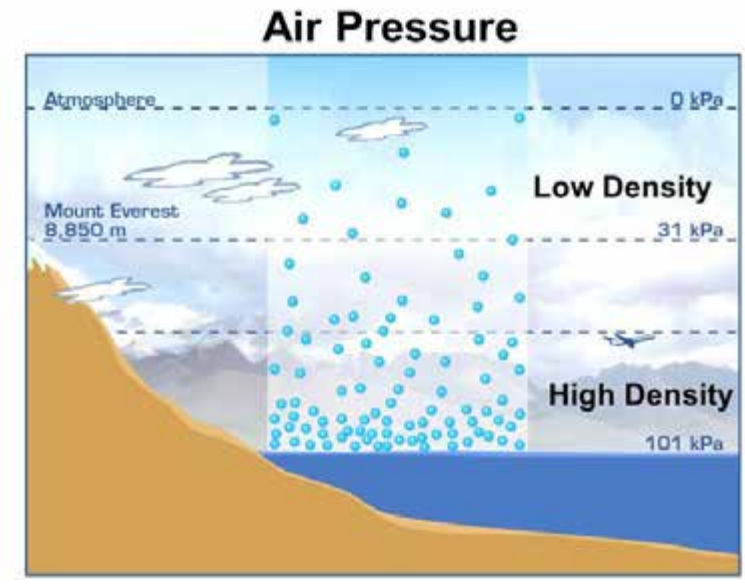
At excessively high temperature physical activity of people is suppressed, probability of diseases of cardiovascular system and kidneys increases.

Low temperature contributes to the development of inflammation of the respiratory system and rheumatism. It is believed that low temperatures and relative humidity of less than 50% contribute to the survival and spread of the influenza virus.

Sudden temperature fluctuations are especially dangerous: they cause disorders of the cardiovascular system and mental disorders. The effect of temperature is amplified in conditions of high humidity.

Changes in atmospheric pressure affect the health of those people who suffer from arthritis and osteoarthritis (diseases that are accompanied by joint pain and changes in their shape).

One of the manifestations of the impact of atmospheric pressure is *mountain sickness*. At an altitude of about 3,000 m, due to drop in blood-gas tension, haemoglobin is insufficiently saturated with oxygen, and hypoxia (oxygen starvation) develops.



At the same time shortness of breath and weakness arises, heart rate accelerates; sometimes a person loses consciousness. At high altitudes (more than 5000 m) may develop pulmonary edema, and due to cerebral hypoxia - coma. Mountain sickness is more common in untrained people, especially those who abuse alcohol.

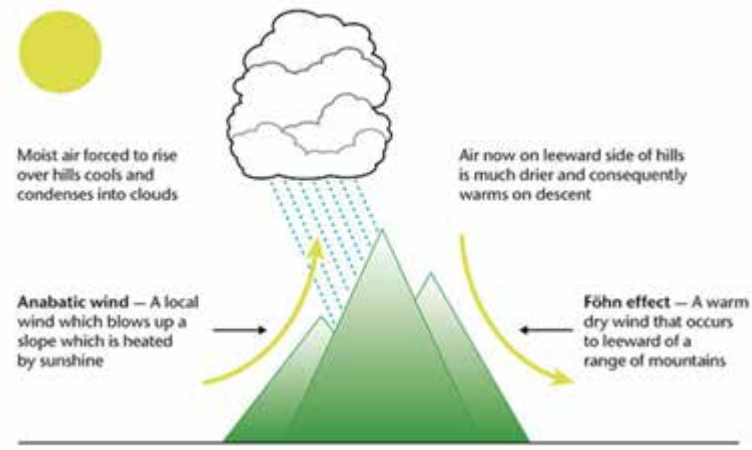
Large and rapid changes in atmospheric pressure can cause *caisson disease*, which is also associated with sudden changes in blood-gas tension and "boiling" nitrogen in the vessels.

The air we breathe is mostly a mixture of two gases, nitrogen (78%) and oxygen (21%). Unlike oxygen, nitrogen is a biologically inert gas, meaning that it is not metabolized (converted into other substances) by the body. For this reason, most of the nitrogen we inhale is expelled when we exhale, but some is dissolved into the blood and other tissues. During a dive, however, the lungs take in more nitrogen than usual. This happens because the surrounding water pressure is greater than the air pressure at sea level. As the water pressure increases, so does the pressure of the nitrogen in the compressed air inhaled by the diver. Because increased pressure causes an increase in gas density, the diver takes in more nitrogen with each breath than he or she would at sea level. Instead of being exhaled, however, the extra nitrogen safely dissolves into the tissues, where it remains until the diver begins his or her return to the surface. On the way up, decompression occurs (in other words, the water pressure drops), and with the change in pressure, the extra nitrogen gradually diffuses out of the tissues and is delivered by the bloodstream to the lungs, which expel it from the body.

The released nitrogen bubbles can cause capillary dropout and is liable to cause fainting and even death. Caisson disease most often develops in scuba divers and deep divers if they violate the rules of ascent to the surface.

Winds significantly affect the human nervous system and mental state. Due to gusty and hot dry winds cases of abnormal behavior of people are sharply increasing.

Many people are affected by wind-related "*foehn disease*", when 1-2 days before the onset of winds in blood and tissues increases level of the biologically active substance serotonin, which affects the transmission of nerve impulses. Some people suffer by headache, nausea and sleeplessness, together with irritability, depression and a general feeling of debility. Medical examination reveals an increased pulse rate and a fall in blood pressure.



Forests are being cut down, steppes are being ploughed out, fertile lands are turning into barren salt marshes, and dry winds are increasingly sweeping over the Earth. Climate and weather are shaken by human, and this inevitably affects his well-being.

Climate change, together with other natural and human-made health stressors, influences human health and diseases. Experts say that 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.

Climate change threatens human health and well-being in many ways, including impacts from increased extreme weather events, wildfire, decreased air quality, threats to mental health, and illnesses transmitted by food, water, and disease-carriers such as mosquitoes and ticks.

Edaphic and hydrological factors. Lack or excess a certain chemical elements and substances in the environment largely determines the health of definite populations.

Diseases associated with regional edaphic (soil), hydrological or epidemiological features are called endemic diseases (i.e., specific to certain regions). For example, iodine deficiency in water and food causes thyroid diseases, calcium deficiency causes bone fragility, and cobalt or iron deficiency causes anemia.

Excess of certain elements is also dangerous. Thus, excess of boron causes digestive diseases and pneumonia. Due to the lack of fluoride, caries usually occurs, but its excess (up to 1 g/l) leads to tooth damage – dental fluorosis; at even higher

concentrations (from 5 g/l) begins ossification of the ligaments (chondrosteosis), function of liver and stomach is disturbed.

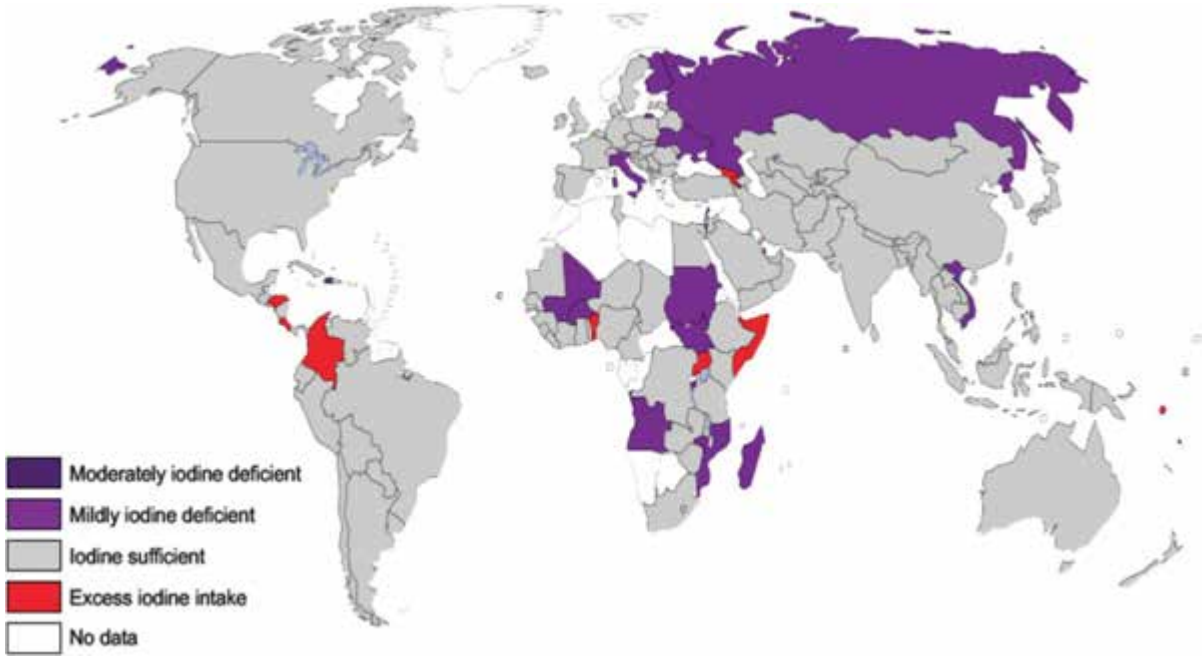


Figure 6.3. Shows countries classified by iodine nutrition in 2017. Iodine intake is inadequate in 19 countries, adequate in 110 and excessive in 10.

(Source: Iodine Global Network Global Scorecard of Iodine Status. http://www.ign.org/cm_data/Scorecard_2016_SAC_PW.pdf)

In many cases, several factors, each of which is in the zone of pessimum, affect in an integrated manner. Thus, low calcium content in combination with excess iron, strontium, lead and zinc causes bone deformation, abnormal cartilage formation or curvature of the spine.

This is an endemic disease called urov disease (also called Kashin-Beck disease), "in honour" of the Urov River (the Trans-Baikal territory), which occurs in areas where the disease is very common. Urov disease occurs in endemic focuses in Eastern Siberia, northern China, and northern Korea. It is believed to result from excess intake of strontium and barium, insufficient intake of calcium, and the ingestion of cereal grains infected with the fungus *Fusarium sporotrichiella*.

In most cases declining health due to lack or excess of certain substances in water and food is associated with a deficiency of calcium, iron, iodine or an excess of certain metals, especially manganese, zinc, lead, mercury, boron.

Lack of trace elements, which are part of vitamins - a common cause of vitamin deficiency (for example beriberi − a disease caused by a vitamin B-1 deficiency).

Beriberi, nutritional disorder caused by a deficiency of thiamin (vitamin B1) and characterized by impairment of the nerves and heart. General symptoms include loss of appetite and overall lassitude, digestive irregularities, and a feeling of numbness and weakness in the limbs and extremities. The term beriberi is derived from the Sinhalese word meaning “extreme weakness.”

Thiamin occurs widely in food but may be lost in the course of processing, particularly in the milling of grains. In East Asian countries, where polished white rice is a dietary staple, beriberi has been a long-standing problem.

The prevention of beriberi is accomplished by eating a well-balanced diet, since thiamin is present in most raw and untreated foods.

6.4 Biotic factors

Biotic environmental factors are factors resulting from the activities of a living thing or any living component in environment, such as the actions of an organism affecting the life of another’s organism.

Human beings, like other living organisms, can enter into various relationships with animals, plants and with their own kind. Some forms of this relationship have developed during the natural evolution of organic society.

From generation to generation, people passed information about the benefits and hazards of any given living organisms. At the same time they used the most long-standing research method − the method of observation.

Useful plants were part of the room culture. Only in the 20th century their utility was scientifically proven. In particular, absorbing some harmful substances, including excess carbon dioxide, houseplants affect the microclimate of the room. In addition, houseplants have aesthetic and recreational value.

The green colour of plants has a positive effect on health. It does not tire the eyes, relieves eye strain, normalizes intraocular pressure, and improves blood supply to the eyes.

In the second half of the twentieth century, aromathology (the study of the influence of odors on human behavior and to examine the relationship between feelings and emotions) began to develop, which attracted the interest of chemists, physicians, and ecologists. Plant aromas have been found to be able to affect respiration, muscle excitability, nervous system, and brain biorhythms.

For example, the scents of lavender and rosemary relieve stress and calm the nervous system. When working with a computer monitor, the number of errors is reduced if you inhale the smells of houseplants: lemon - by 54%, jasmine - by 33%.

Many houseplants are grown due to their excellent property - to emit phytoncides into the environment.

Phytoncides are bactericidal (bacterial antagonists), fungicidal (antagonists of fungal infection), antiprotozoal (antagonists of protozoa) volatile substances, which play a significant role in the relationship of organisms in plant communities and they are one of the factors of natural plant immunity.

Phytoncides increase the bactericidal ability of air, making it clean. The mechanism of this phenomenon is associated with the transformation of ozone molecules into electronically excitable oxygen molecules - ozone, which can destroy the DNA structure of pathogenic microorganisms.

A bactericidal property of air, which contains volatiles, determines its properties, such as freshness.

Fresh air cures many diseases; it also improves health: it has a positive effect on the nervous system, increases motor activity and secretory function of the gastrointestinal tract, improves metabolism, stimulates cardiac function.

There is a need to make serious the theory of phytoncides in close connection with the theory of phytodesign. Plants, properly selected and placed with good taste, create a psychologically favourable environment, have a positive effect on people's mood, give the room a unique colour and a certain comfort.

6.5 Anthropogenic impact on nature and human health

As a result of their economic activity, today humanity already affects the Biosphere 2.000 times more than the Biosphere has an effect on herself.

According to forecasts, this will lead to huge global changes over the next 50 years. The area of deserts will increase by 50%, a quarter of all living beings will disappear; it may be possible to destroy the Biosphere as a self-sufficient system and create a fully controlled subsidiary economy of the Noosphere instead. The Noosphere itself as a system is likely to survive, but the world will change radically with unpredictable consequences for the further evolution of the Noosphere.

The sphere of distribution and evolution of life − the biosphere − has existed for more than three billion years.

Human evolution within the biosphere takes place at the stage of bio- and anthropogenesis.

Gradually, humanity becomes a powerful factor in the biosphere, which changes the structure the very foundations of the biosphere.

But we do not rule over nature, we are inside it. The highest social pattern play a leading role in human society and the biosphere as long as they do not conflict with the laws of biology, chemistry, physics, etc. The highest social pattern is not

able to stop the laws which are leading at all levels of nature development, although it has a real opportunity to use them for itself.

Mankind needs to realize that our planet is a kind of living organism that lives in accordance with certain principles, laws and norms of existence.

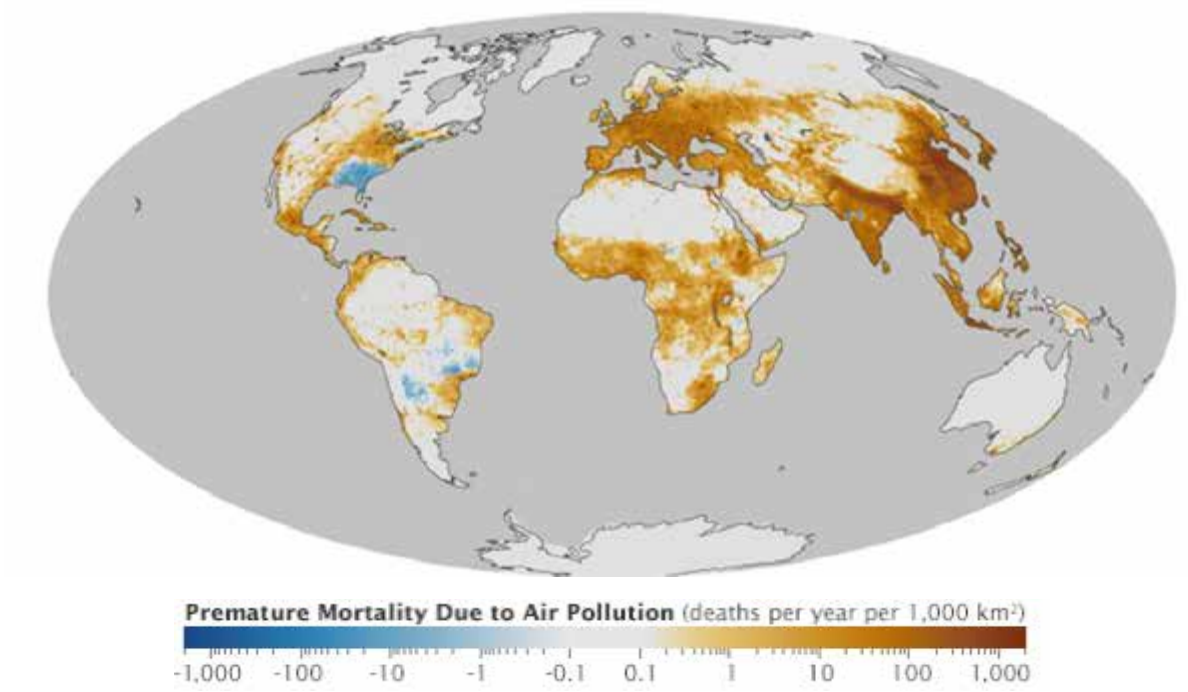


Figure 6.4. The model estimate of the average number of deaths per 1,000 square kilometers (386 square miles) per year due to air pollution (January 1, 1850 - January 1, 2000)

(Source: https://earthobservatory.nasa.gov/images/82087/the-global-toll-of-fine-particulate-matter)

Ignoring this situation, spontaneous use on a gigantic scale of resources of the inorganic world and the biosphere has led to unpredictable serious violations of the laws of the biosphere, in particular the laws of the biotic cycle, caused by anthropogenic pollution.

Chemical, radioactive and bacteriological contamination of air, water, soil and food, as well as noise, vibration, electromagnetic fields and other physical

contamination of the environment cause genetic changes in the human body and severe pathological phenomena. This leads to an increase in diseases, the birth of disabled children, premature aging and death (see Fig. 5.4. above).

The end of the XX century was marked by the fact that as a result of the scientific and technological revolution and urbanization of our planet, the negative impact of violations of the Earth's biosphere on human health has increased significantly.

The human body is no longer able to adapt quickly to these rapid and global changes. Anthropogenic pollution of environmental components is a particular threat to human health.

Atmospheric air pollution is a common cause of inflammatory diseases of the respiratory system and eyes, diseases of the cardiovascular system, infectious diseases and lung cancer. In areas with polluted air, children are more likely to get sick. They have low body weight and level of physical development, as well as functional disorders of the cardiovascular and respiratory systems. The incidence of respiratory diseases is about 75% of the total number of diseases.

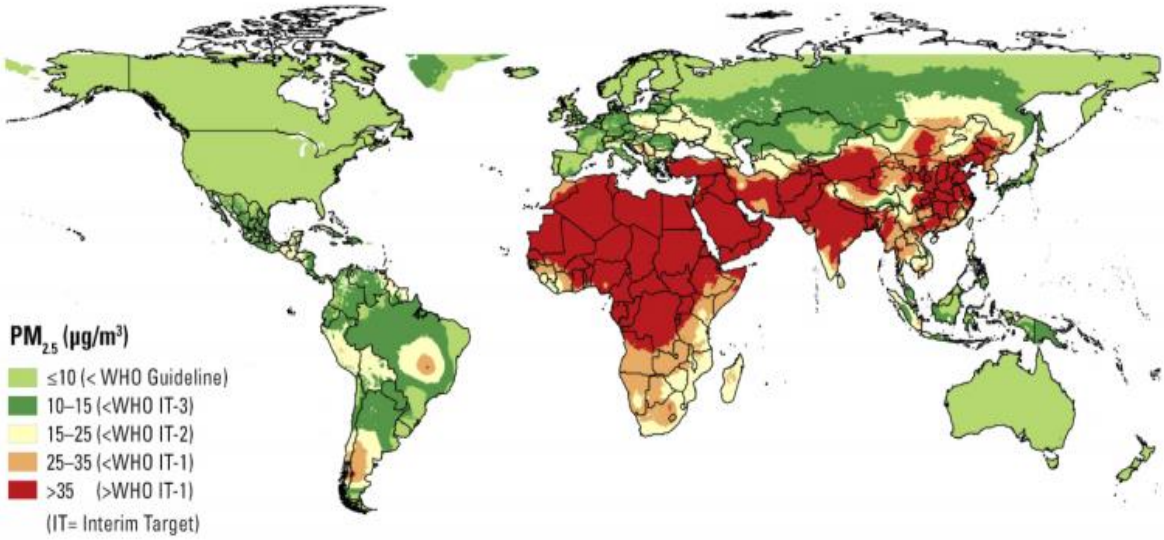


Figure 6.5. Annual average PM2.5 concentrations in 2017 relative to the WHO Air Quality Guideline

(Source: https://www.stateofglobalair.org/)

Water is also one of the most important environmental factors. It is necessary to ensure the viability of the human body. Water pollution is the cause of many diseases. Diseases caused by chemical and bacteriological water pollution occur due to the ingress of contaminated wastewater into water bodies.

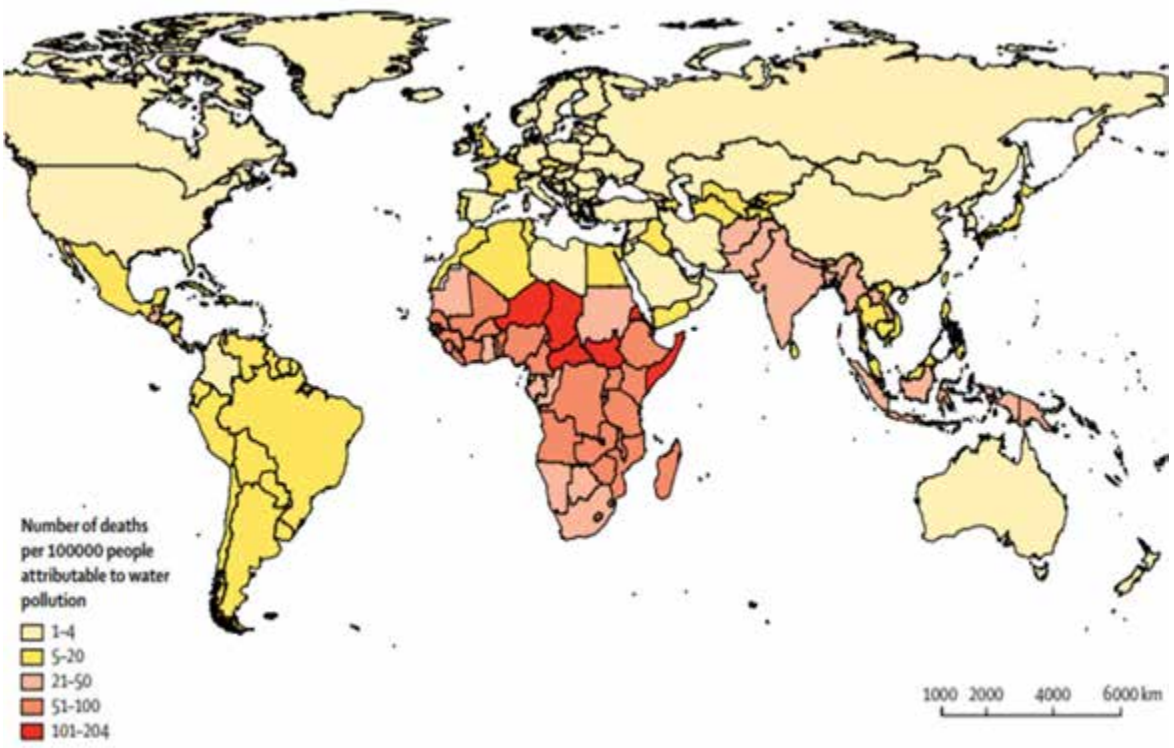


Figure 6.6. Number of deaths per 100000 people due to water pollution, 2015

(Source: The Lancet Commission on pollution and health)

Intestinal infectious diseases (cholera, typhoid fever, dysentery, tuberculosis, leptospirosis, anthrax etc.) pose the greatest danger of spreading diseases by water.

According to the WHO, 80% of all diseases in economically underdeveloped countries are associated with poor quality water and violations of sanitary and hygienic standards.

Chemical contamination of water with mercury causes Minamata disease which is characterized by severe damage to the central nervous system (there are disturbances in motility, a weakening of vision and hearing, severe headaches, muscle weakness, paralysis, coma and often it may be fatal.

Minamata disease in Japan is the most famous case of methylmercury food poisoning. The first patient was officially notified to the local Public Health Center in May 1, 1956. The source and transmission mode is contaminated fish and shellfish. The etiologic agent is methylmercury, a by-product of acetaldehyde production, which was discharged from the Chisso factory from 1932 until 1968. During this period, the discharge was not stopped, and no effective measures or investigations were undertaken.

This quite severe and deadly disease has become a kind of symbol of the combat to environmental pollution, in connection with which harmful industrial waste entering the atmosphere, water, etc. and leads to the development of new serious diseases.

Elevated concentrations of nitrates in drinking water cause cyanosis, methemoglobinemia, and difficulty breathing in infants. There is a correlation between the concentration of nitrates in water and the incidence of cancer of the stomach, bladder, kidneys, small intestine, esophagus and liver.

Synthetic detergents cause skin irritation and allergies, dermatitis, metabolic disorders of skin and whole body.

Changes in the trace element content in the water can cause diseases such as goiter, fluorosis, caries and things like that. Increasing the amount of fluoride in drinking water to 1.9 mg/l causes the appearance of fluorosis, which is characterized by damage to the teeth with the formation of yellow-brown pigment spots, enamel defects and so on.

Contamination of soils with mineral fertilizers, pesticides and industrial and domestic wastewater led to the fact that the soil became a source of tuberculosis, brucellosis, paratyphoid and other diseases of the digestive tract as well as helminthiasis.

Pesticides and fertilizers are the cause of many poisonings. Getting into drinking water and food, they disrupt the central nervous, cardiovascular and other systems, cause the growth of malignant tumours and reduce life expectancy.

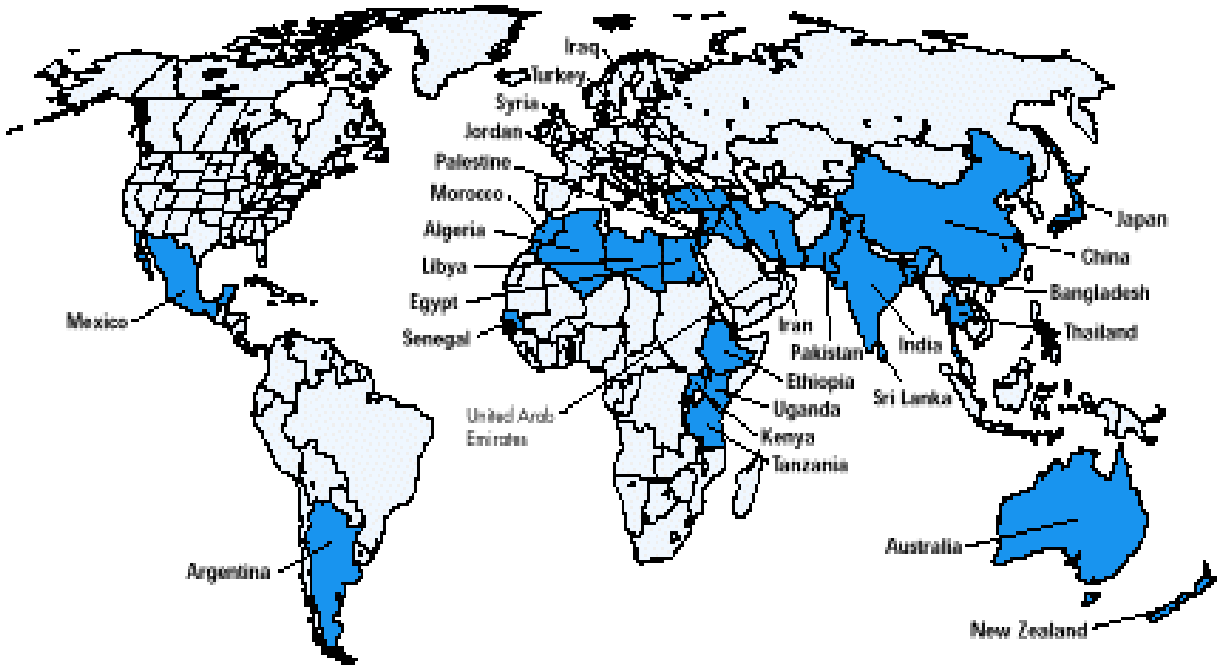


Figure 6.7. Countries with endemic fluorosis due to excess in drinking water

(Source: https://fluorosis.foundation/fluorosis/global-profile/)

Industrial emissions and wastes contaminate soils with sulfur, iron, lead, zinc, mercury, copper, magnesium and many other constituents and cause poisoning through plant and animal foods and drinking water.

Contamination of soils with radionuclides is especially dangerous. The effect of these contaminants on the human body tends to persist over time and across generations.

Prolonged exposure to radiation leads to the development of radiation sickness, to local defeats of skin, crystalline lens, bone marrow, pneumosclerosis and so forth. Small doses of radiation have long-term consequences. In industrialized countries, every 4th to 6th person gets cancer, and 6-10% of newborns have genetic disorders.

The tragic consequences of the Chernobyl nuclear power plant accident pose a threat to the nation's genetic health. More than 600 settlements have been affected by radioactive contamination. Radioactive decay products have created a high radiation level, which contributes to the external irradiation of people.

Radioactive iodine accumulates in the thyroid gland, and then with its hormone's spreads in the body, is broken down in liver and partially excreted through kidneys.

Radioactive cesium is deposited mainly in muscles, penetrates into cells and irradiates the body.

Plutonium is transformed into americium and absorbed by the body, causing serious illness.

The number of gastrointestinal diseases is increasing among the population, and cases of anemia have become more frequent among children and pregnant women.

The state of the genetic fund of the population, predisposition to hereditary diseases is essential. They make up about 17 - 20% of the factors that determine the current level of public health. Health and medical care and directly preventive programs account for 10% of the allocations of the entire budget.

The statistics of morbidity of the population of Ukraine, based on the registration of patients' visits to the doctor, shows that in the structure of morbidity the first place is occupied by respiratory diseases, they are followed by diseases of the circulatory system, in third place are diseases of the nervous system and sense organs.

Since 1992, there have been significant changes in incidence of disease among the population of Ukraine. There is an increase in the overall incidence of 27.0%.

The morbidity of diabetes has increased by 2.1 times, bronchial asthma − 2.1 times, stomach ulcers and 12-digit intestines − 1.9 times.

Especially significant growth is observed by class of diseases of the circulatory system: the incidence of angina has increased by 8.6 times, acute myocardial infarction − by 2.6 times.

For other groups of diseases there is also an increase in disease burden. Thus, malignant neoplasms increased by 27.8%, thyrotoxicosis − by 21.2%, mental disorders − by 26.8%, chronic otitis − by 32%.

Table 6.2 Death rates for selected non-communicable diseases in Ukraine, 2020

(Source: State Statistics Ukraine)

	Ukraine	% all deaths	Per 100 000
All deaths	616 835	100	1620
CVD	408 163	66	1072
Cancer	77 880	14	204
Diabetes	2122	<1	6
Mental health disorders	971	<1	3

In recent years, there has been an increase in the incidence of blood and hematopoietic diseases by 51.3%, congenital malformations − by 21.5%, circulatory diseases − by 54%, chronic bronchitis − by 21%, gallstones disease − by 28%.

Over the past 10 years, the incidence of diabetes has increased 1.6 times, the proportion of which among endocrine diseases is 70% or more. The country has a tendency to increase the prevalence of hyper- and hypofunction of the thyroid gland and so on.

Thus, the state of health reflects the dynamic balance between the natural environment and organism. Human health, as noted above, is influenced by lifestyle, genetic and environmental factors.

Homeostasis is considered to be the relative dynamic constancy of the internal environment and some physiological functions of human and animal organisms, which is supported by the mechanisms of self-regulation in the conditions of fluctuations of internal and external stimuli.

Human health, ensured by the homeostasis of his body, can be preserved in the event of some change in environmental factors. Such changes cause the appearance of appropriate biological reactions in the human body, but due to the processes of adaptation, they do not lead to negative health consequences within certain limits of the change of factors. For everyone, these boundaries are different.

The process of adaptation depends on the individual reactivity of the organism and the impact of environmental factors.

The criterion for the degree of adaptation is the preservation of homeostasis regardless of the duration of the factor to which the adaptation was formed.

In the conditions of the disease there is compensation that is body fighting for homeostasis. This includes additional protective mechanisms which counteract the emergence and progression of the pathological process.

In the case of signals of a real danger and lack of involved mechanisms, stress-related illnesses such as diabetes, coronary heart disease, hormonal dysfunctions, occupational diseases, etc. arise.

Self-control questions to Topic 6:

1. The concept of "human health". How the term "health" is defined by the World Health Organization?

2. The concept of "human health" covers:

a) dynamic balance between the human body and the environment;

b) adaptability of the human body to changing environmental conditions;

c) physical, spiritual, social well-being;

d) all the above answers are correct.

3. Risk factors for the formation of human health:

1. Way of life	*A. predisposition to hereditary diseases*
2. Genetics	*B. ineffectiveness of preventive measures*
3. External environment	*C. drug use, unbalanced diet, working conditions*
4. Health care	*D. pollution of air, soil, water*

4. Way of life as a biosocial category. What is a person's mode of life determined by?

5. The standard of living is primarily:

a) an economic category;

b) a social category;

c) a socio-psychological category;

d) a biological category.

6. The most complete relationship between lifestyle and health is expressed:

a) as the model that reflects the psychophysiology of the individual;

b) in the concept of "healthy lifestyle";

c) as a system of social and environmental conditions;

d) in the concept of optimal working performance.

7. Do environmental factors affect human in the same way as any other species?

8. What happens to human when values of certain factors go beyond the optimum range?

9. Ultraviolet in small doses:

a. has an antiseptic and bacteriostatic effect;

b. causes behavior disturbances;

c. inhibits the development of pathogenic fungi;

d. causes mostly harmful mutations.

10. Mountain sickness is one of the manifestations of the impact of:

a. relative humidity;

b. temperature;

c. atmospheric pressure.

11. What is the most well-known wind-related disease?

18. Name the ways in what climate change threatens human health and well-being.

19. In most cases declining health due to lack or excess of certain substances in water and food is associated with a deficiency of … or an excess of certain metals, especially ….. (fill in the omitted words)

20. What are the links between the results of the scientific and technological revolution and urbanization and human health?

21. Skin irritation and allergies are the result of impact:

a. pesticides and fertilizers;

b. green colour of plants;

c. synthetic detergents;

d. excess of fluoride.

22. Soil contamination by industrial emissions and wastes cause poisoning through

a. plant foods;

b. animal food;

c. drinking water;

d. all the above answers are correct.

23. What is the danger of soil contamination with radionuclides for human health?

24. The criterion for the degree of adaptation is the preservation of … regardless of the duration of the factor to which the adaptation was formed.

Section 7.
DEMOGRAPHIC PROBLEMS OF UKRAINE. ECOLOGICAL AND ECONOMIC PROBLEMS OF URBAN AREAS

7.1 Specifics of the current demographic situation in Ukraine

The study of the biosphere, its age and spatial components, the impact of anthropogenic factors on it cannot be studied outside of man, human populations, and humanity as a whole.

Problems related to these issues are studied by demography (from the Greek word *Demos* − people and *grahpo* – to write) − a social science that studies the population and patterns of its development.

Demography applies the principles of population ecology to the human population. Demographers study how human populations grow, shrink, and change in terms of age and gender compositions using vital statistics about people such as births, deaths, population size, and where people live. Demographers also compare populations in different countries or regions.

The demographic problems of humanity, along with the issues of the structure of society, migration, ethnic, racial and religious composition, determine the ecology of human communities, which validates the anthropocentric approach in environmental science.

According to World Bank experts, from 60% (for example, in Poland) to 80% (in Japan and Germany) of GDP in developed countries is generated not by physical, financial or even natural resource capital, but by human capital. Human capital is people as they are, their health, education, qualifications, gender and age composition, ability to unite and enter into certain relationships.

The population of the territory changes due to the action of two processes - natural movement of the population and mechanical movement (migration). The magnitude of absolute population growth thus depends on four components: the

number of births and deaths, as well as the number of immigrants and emigrants identified during the considered period.

As Ukraine crossed the thirty-year mark of the period of establishing its independence and fundamental socio-economic transformations, it must be recognised that the socio-demographic situation in the country remains extremely unfavourable. Its crisis nature is determined by the combination of large-scale depopulation and deterioration of the qualitative characteristics of the population, including the state of health.

The full-scale war and its negative consequences only exacerbated the demographic problems that had been accumulating for 30 years - by 24 February 2022, they were already a serious challenge for the Ukrainian state. Demographic losses include excessive mortality, births, and increased out-migration.

Population change. Since independence, Ukraine's population has been steadily declining, primarily due to an excess of deaths over births. In 1991, Ukraine was home to almost 52 million people, but by 2021, the total population had fallen to 41.6 million (Figure 7.1).

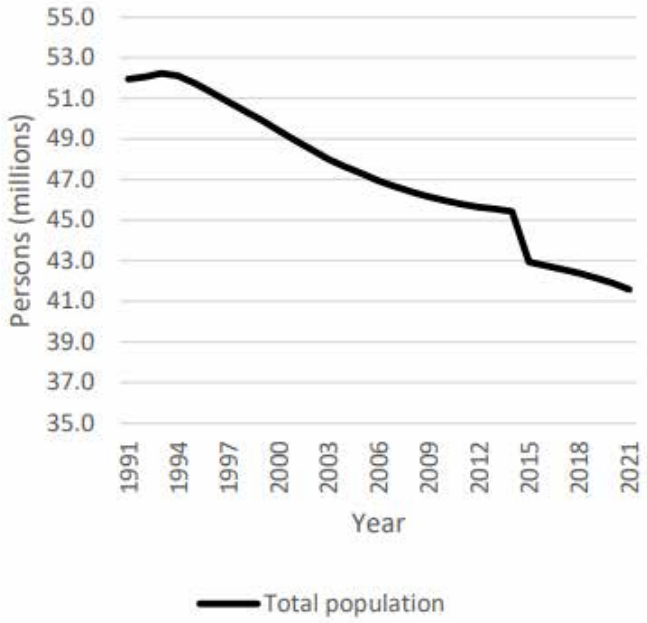


Figure 7.1. Ukraine's population, 1991-2021

(Source: State Statistics Service of Ukraine, 2022)

The decline has been gradual, with the exception of a sharp decline in 2014-2015 from 45.4 million to 42.9 million. In November 2021, the UN stated that Ukraine's population is declining at one of the fastest rates in the world.

Mortality and fertility. Overall, in the years before the war, mortality in Ukraine declined slightly, and life expectancy at birth even increased slightly between 1991 and 2020 (Figure 7.2).

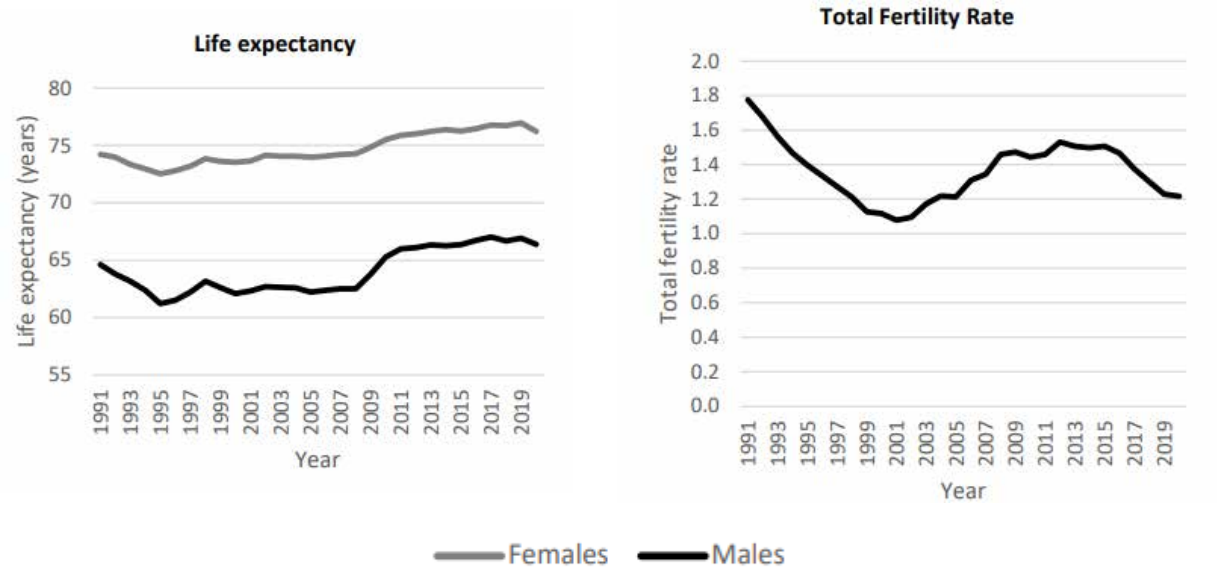


Figure 7.2. Life expectancy at birth and Total Fertility Rate in Ukraine, 1991-2020

(Source: State Statistics Service of Ukraine, 2022)

Life expectancy in 1991 was 69.6 years, while in 2020 it was 71.4 years. Life expectancy for men (65.1 years) is almost 10 years lower than for women (74.4 years). High mortality rates among men of working age are attributed to alcohol-related causes (about 15% of the gap), smoking (32%) and biological factors (13%).

The mortality situation is likely to deteriorate due to the war, but there is no reliable information on this: there is no reliable data from the occupied territories; data on the frontline areas is eclectic; only the areas not directly affected by the occupation have fairly reliable information. Additional losses (deaths due to war) include not only military and civilian casualties, but also deaths due to many other

causes, including constant stress, hypothermia, lack of proper nutrition, lack of quality medical care, immunisation deficiencies, etc.

The socio-economic crisis of the 1990s accelerated and intensified unfavourable trends in the dynamics and structure of other major demographic processes. In particular, during the first transformation decade in Ukraine, the birth rate declined steadily and at an accelerated pace, and one-child and childlessness became more common.

In 2020, Among the main factors behind the low fertility rate and its unfavourable trends in our country, we should first of all highlight the fact that the demographic reproduction process was not sufficiently economically supported.

A Ukrainian woman gives birth to an average of 1.2-1.5 children in her lifetime, and for simple intergenerational reproduction, this figure should be 2.2. In 2021, it was exactly half that - 1.1 children per woman, thus the total fertility rate in Ukraine was one of the lowest in Europe. The lowest fertility rate (0.9) in independent Ukraine was recorded in 2001.

And in 2023, it is expected that 10 women will have only 7 children on average, meaning that the fertility rate will drop to 0.7 children per Ukrainian woman. This is a demographic catastrophe.

International migration. As shown in the Fig. 7.3, net migration in Ukraine has been positive since the early 2000s. The age profiles of incoming and outgoing migrants are quite surprisingly similar. Young people (aged 15 to 35) were more likely to immigrate to and emigrate from Ukraine, and young children were also more likely to leave and arrive with their parents. Between the ages of 20 and 44, women had higher rates of entry and exit than men.

Until February 2022, migration processes in Ukraine were influenced by a number of important factors, such as the annexation of Crimea and the conflict in eastern Ukraine and the economic recession they caused; the launch of important reforms, which, however, proved to be insufficiently thorough and consistent; progress in European and Euro-Atlantic integration, including the introduction of a

visa-free regime with the EU in 2017; migration experience and diversified migration networks developed through many years of active participation of Ukrainians in labour migration abroad.

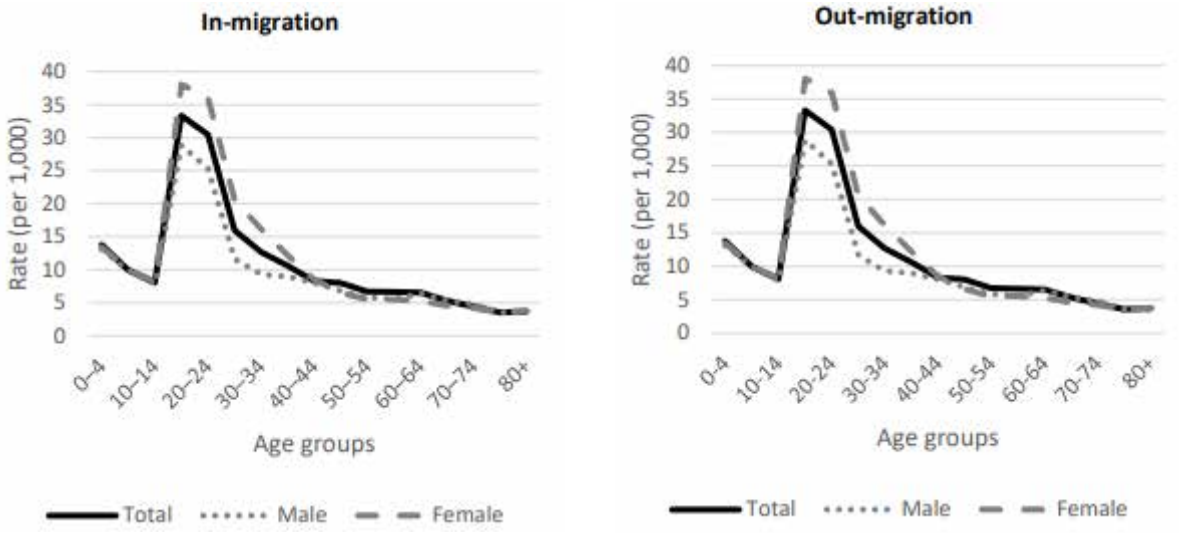


Figure 7.3. In- and out-migration rate in Ukraine by age (5-year groups) and sex, average rates for 2016-2020

(Source: State Statistics Service of Ukraine, 2022)

One of the consequences of the war is the large-scale migration of the Ukrainian population abroad. As of 8 November 2022, more than 7.8 million Ukrainian refugees were forced to leave Ukraine, almost 4.7 million of whom were granted temporary protection

The vast majority of migrants are women and children (90%). According to a sociological survey conducted by the Razumkov Centre (July-August 2022), it was mostly people of working age who went abroad (30-39 years old - 42%, 40-49 years old - 29%). 83% have higher or incomplete higher education. 30 per cent of Ukrainian refugees are highly qualified specialists, 12 per cent are skilled workers, 14 per cent are managers of enterprises or departments, and 14 per cent are entrepreneurs.

The prolonged nature of the war, the destruction of Ukraine's economic structure, and the difficult period of socio-economic recovery of the country after

the war increase the risk of a significant proportion of this category of the population not returning home. Meanwhile, the number of young people is also decreasing, which threatens to deteriorate the quality of the country's demographic potential in the medium and long term.

Internal migration. According to the International Organisation for Migration, internal displacement within Ukraine reached about 8 million people.

The massive internal displacement of people from the regions temporarily occupied or where active hostilities are ongoing has changed the demographic composition of some regions of Ukraine, primarily in the eastern and southern regions. This has had a significant impact on the number, age and gender structure of their population, as most women (of all ages), children and adolescents have left their places of residence.

Internal migration also causes a number of other problems, including language and cultural adaptation, unemployment, lack of adequate provision of quality educational and medical services, and basic living conditions. Unemployment is one of the main problems.

The largest number of women with unemployment status is concentrated in the regions with the highest number of internally displaced persons, which means that effective support and proper social protection for women with children (socially vulnerable groups) should be provided there.

Population composition. Ukraine's population structure changed markedly from the early 1990s to 2020 (Fig. 7.4). In 1992, the largest group was made up of persons born in the 1930s, and the population structure was young with large groups of persons aged 5 to 45.

However, at that time, there was already a noticeable decrease in the number of children in the 0-4 age group. In 2020, the population structure by age and gender looks much different. The pyramid shows an ageing population and a gender imbalance. The 0-20 age group is relatively small, and women outnumber men in middle and older age. Overall, Ukraine's past demographic trends, especially large

out-migration in the second half of the 1990s and early 2000s and low fertility since the mid-1990s, have resulted in an ageing and shrinking population, making it vulnerable to any external shocks.

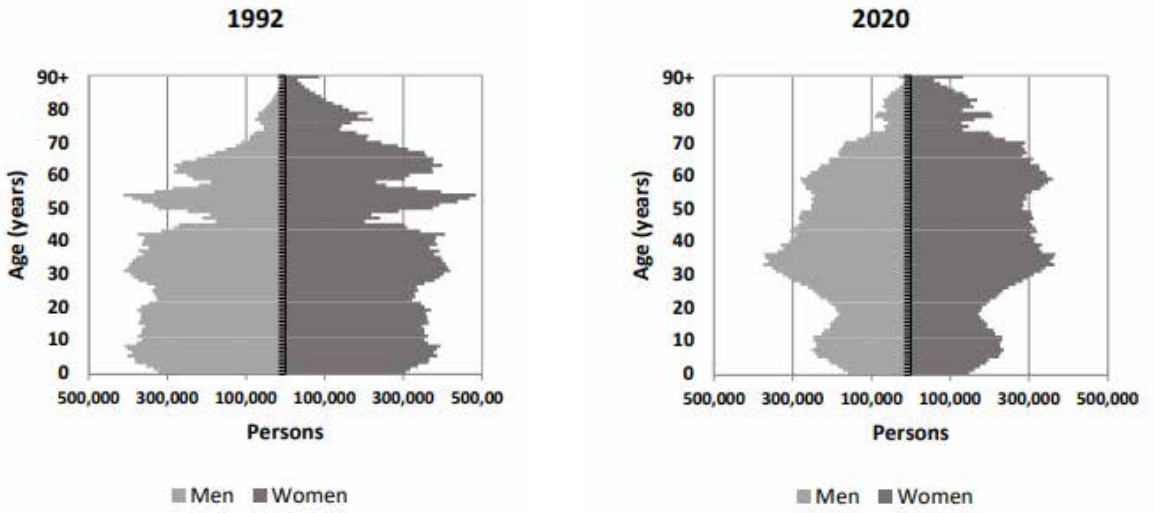


Figure 7.4. Ukraine's population by age and sex in 1992 and 2020

(Source: State Statistics Service of Ukraine, 2022)

Marriage and family structure of the population. The family is one of the main social institutions in society and the main demographic unit. It performs many social functions, including demographic functions include:

1) giving birth and raising children;

2) creation of conditions conducive to improving the health and life expectancy life expectancy of family members;

3) ensuring their own stability (this is an important function, since the stability of the family institution and the stability of society are largely interdependent). It is no exaggeration to say that reproduction of the population almost entirely takes place in the family.

In modern Ukraine in general the traditional family way of life of the population was retained; family continues to perform its specific functions for supporting physical and socio-cultural replacement of generations, although the forms of family associations and marital relations, as in other European countries, are transforming and becoming more diverse.

At the same time, there are socio-demographic phenomena, the current scale of which indicates unfavorable conditions for the existence of the family, a certain deformation of its specific functions. They are reflected in the significant share of single-parent families among families with children, high divorce rate and a significant number of children - social orphans.

More than a third of divorces in Ukraine are among young couples who who have been married for less than five years. Recently, the country has been experiencing about 800,000 marriages are dissolved annually, leaving about 400,000 of minor children remain in single-parent families.

A fundamental feature of the current demographic situation in Ukraine is the crisis of health and vitality of the population. High morbidity of children and adults – this is one of the most important signs that characterize the unfavorable medical and demographic situation in the country.

In recent decades, the rural population has declined sharply and the urban population has increased by more than 65%. Currently, 69.2 % of the population of Ukraine is urban (30,425,950 people in 2019).

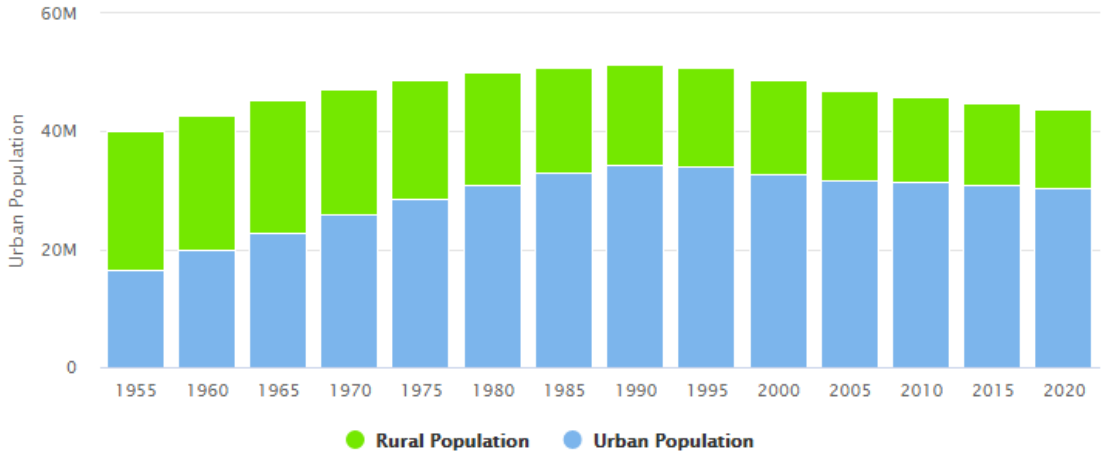


Figure 7.5. Urban versus rural population of Ukraine, 1955-2020

(Source: https://www.worldometers.info/world-population/ukraine-population/)

The severity and urgency of today's socio-demographic problems, the unfavorable nature of the demographic situation in Ukraine cause an urgent need for the formation and implementation of effective public policy to address demographic problems, as well as forestalling the concentration of efforts in those areas that are most closely associated with changes in the qualitative characteristics of the population and the parameters of self-reproduction.

Social and demographic policy in Ukraine should be focused on:

- Creation of socio-economic prerequisites for the full functioning and development of the family;
- Creating and satisfying the need for children;
- Improving the health of the population;
- Reducing premature mortality from causes and preventable diseases;
- Improvement of the quality and increase in the life expectancy of chronically ill and disabled persons;
- Optimisation of external labour migration of Ukrainian citizens; prevention of illegal migration;
- Activation of migration reserves to mitigate depopulation;
- Adapting to the process of ageing in society.

7.2 Ethnos as the source of the ecological and social system

A people (in Greek, *ethnos*) are a very complex concept. Most often, this term is understood as follows: an ethnos is a historical community of people that has developed in a certain territory and has stable patterns of language, culture and mental composition, as well as an understanding of its unity and difference from others.

The established ethnos acts as a social organism that reproduces itself through mostly ethnically homogeneous marriages and the transfer of language, traditions, etc. to new generations. In order to be more sustainable, an ethnos strives to create its own socio-territorial organisation (state), and ethnic groups, especially in current

conditions, strive to create their own autonomous associations and enshrine their rights in legislation.

For the internal unity of an ethnic group, culture is of paramount importance, as it makes people aware of their commonality. Culture, both as a vital component and as one of the features inherent in an ethnic group, ensures its full functioning. But there is also a reverse process - the convergence (rapprochement) of ethnic cultures as a result of historical development and interaction between peoples. That is why today the culture of each ethnos is characterised by a combination of nationally specific and, on the other hand, universal components.

The development of ethnic culture is inseparably linked to the development of the people themselves (ethnogenesis). So, when considering Ukrainian culture, one cannot but dwell on the problems of ethnogenesis of Ukrainians.

Most contemporary literature considers the period of Kyivan Rus to be the beginning of the Ukrainian national genesis, although it did not reach its conclusion at that time. Later, as a result of unfavourable historical factors, this process was interrupted and began again in full force in the XV-XVII centuries. This is likely to be the specificity of the ethnogenesis of Ukrainians.

The difficulties of the ethnic history of Ukrainians are also reflected in the variety of self-names (ethnonyms), names given by other peoples, as well as the names of the state and the country. Since the birth of the Ukrainian ethnos, the concept of Rus has been key. And in different periods, the following variants of it dominated: VI-XI centuries - Rus; since 1395 - Little Rus; in the XVII-XVIII centuries - Malorossia; XIX century - early XX century - Ukraina-Rus. Only since the early twentieth century has the ethnonym "Ukraine" become dominant.

As for the self-name "Ukrainian", it has long been rarely used. This can largely be explained by the difficulties of ethno-social evolution. The terms "Cossack" and "Cossack people" were synonymous, while the old self-designations "'Rus'ki'" and "Rusyns" continued to exist. It was only in the context of the national revival in the

second half of the nineteenth century that the self-name "Ukrainian" finally prevailed.

Today, Ukrainians are the majority of the population of Ukraine. They are one of the largest peoples in Europe and the 2nd largest in the Slavic world. At the last census (2001), Ukrainians accounted for almost two-thirds of the population (77.8%). In general, Ukrainians are evenly distributed throughout the country, with the exception of Crimea and the south-east. In rural areas, they account for up to 90% of the population, and in cities - up to 70%.

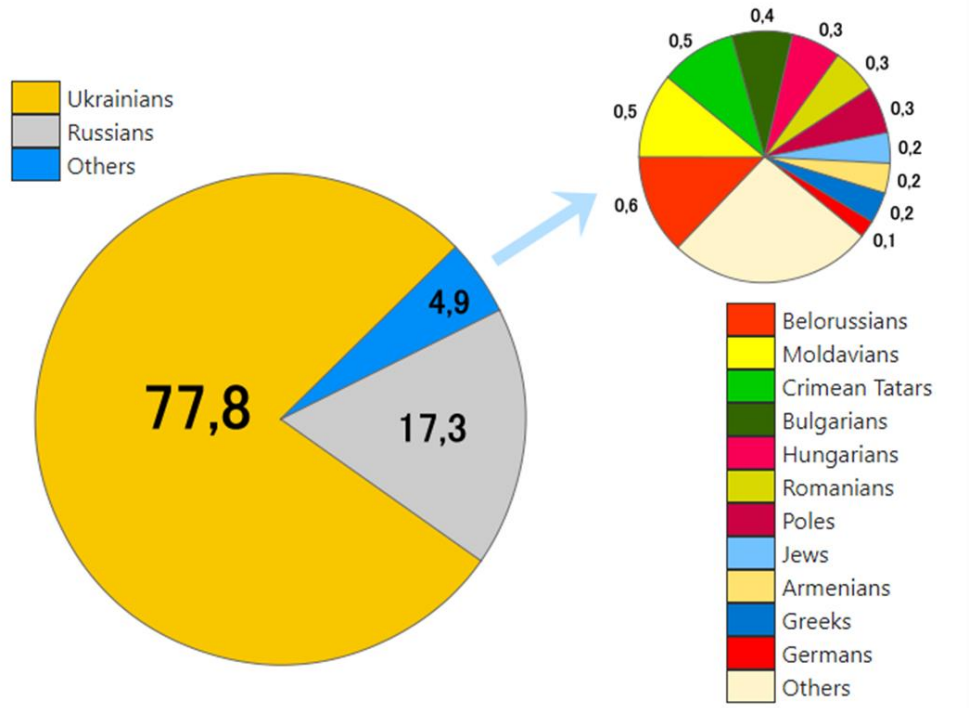


Figure 7.6. National composition of the population by data All-Ukrainian population census'2001 data

Ukrainians belong to the Slavic group of the Indo-European ethno-linguistic family. The Ukrainian ethnos consists of:

- the main ethnic group of the Ukrainian people, which mainly coincides with the territory of its formation and the state boundaries of Ukraine;

- ethnic groups of Ukrainians beyond the main ethnic group in neighbouring and far abroad - the diaspora;

- sub-ethnic groups, that is, communities among Ukrainians with specific cultural features (Hutsuls, Lemkos, Boyky, Polischuks, and others).

The traditions and lifestyle of the Ukrainian people, which include many national qualities, still have a number of territorial features. They are caused by

- the nature of the historical development of certain regions of Ukraine;

- the natural and geographical situation;

- interconnections with other nations.

Ukraine still has ethnographic groups that have their own cultural and linguistic characteristics. The most significant of these are the Ukrainian Highlanders (Hutsuls, Lemkos, Boyky) in the Carpathian region and Polishchuks, Pinchuks, and Litvyns in Polissya.

There used to be more such groups among Ukrainians. However, with the development of capitalism, and then in soviet period, many archaic, conservative customs and rituals gradually became a thing of the past, and new elements in the everyday life and spiritual life of the peasantry, which formed the majority of Ukrainians, developed. Elements of urban wear, new types of housing, and tools became widely distributed.

In other words, socio-economic conditions have become decisive factors that have shaped the modern face of the Ukrainian nation, influenced the size and geographical distribution of other ethnic groups, and the nature of ethnic processes in Ukraine as a whole.

The essential feature of any nation is its language. Most Ukrainians speak Ukrainian, a language that was formed on the basis of territorial elements of the Old Rus language (although there are other views). The basis of the modern Ukrainian literary language at the turn of the 18th and 19th centuries was the Middle Dnipro (Poltava-Kyiv) dialect.

These are the main aspects of the development of the Ukrainian ethnos, a highly complex process, with many problems that are still controversial.

7.3 Impact of the urban environment on human health and behaviour

Urbanisation is the process of increasing the role of cities in the development of society. Special urban relations cover the socio-professional and demographic structure of the population, its way of life, placement of production and settlement.

Figure 7.7. Share of the urban population by continent in 1950 and 2020 (in percent)

(Source: UN Population Division)

The prerequisites of urbanisation are: industrial growth, deepening of territorial division of labour, development of cultural and political functions of cities.

In large cities, the natural habitat, rhythm of life, psycho-emotional environment of labour and everyday life are most strongly changed, and the climate is also disturbed. The intensity of solar radiation in cities is 15 - 20% lower than in the surrounding countryside, the average annual temperature is higher (by about 1.5°

C, less significant daily and seasonal temperature fluctuations, more frequent fogs, more precipitation (on average by 10%), lower atmospheric pressure.

Practically all these changes have extremely unfavourable effects on human physical and mental health.

Humans are part of nature and can live in a very limited by its parameters environment. The human living environment in a large city is a complex system of social and environmental impacts on the organism at various stages of its development. This cannot but affect the psyche of an urban resident, and the impact of this environment on rural residents who moved to the city is even more significant, as their social and material status, the character of labour and recreation, living conditions and the whole way of life changes.

Social conditions, information and intellectual overload cause mental fatigue and emotional stress among city dwellers. They cause the majority of stomach ulcers and 4/5 cases of myocardial infarction. Emotional stress accompanies conflict situations, disorganisation of the social environment closest to a person. Urbanisation is associated with the destruction of the former way of life and requires a significant restructuring of personality.

Modern people are in a much more difficult position than before, as the rate of historical transformation of society has become commensurate with the time of an individual's life.

A city resident has to solve tasks that require great psychological effort, he is forced to lengthen his working hours, reducing his rest and constantly feeling the lack of time. He is bombarded with an excessive flow of information on a daily basis. As a result, many people react to this overload with neuroses and so-called "diseases of civilisation".

The present day is characterised by a rapid increase in social change, while biological processes change extremely slowly. This discrepancy is the first cause of the "diseases of civilisation". It finds its concrete expression primarily in the so-called neurosis of unreacted emotions.

Negative emotions in humans and animals are accompanied by the release of large amounts of adrenaline into the bloodstream. It is also released during mental tension, anger and fear, i.e., when mobilisation of all body forces is necessary. Adrenaline causes increased cardiac activity and blood pressure, accelerates blood clotting, increases the lumen of the bronchi, inhibits the work of the stomach and intestines, stimulates the work of transverse striated muscles, especially when fatigue. This effect is due to the fact that in animals and human ancestors, negative emotions were always followed by intense physical exertion - running or wrestling. Therefore, all released catecholamines were realised during physical exertion.

In modern humans, physical exertion is not always followed by negative emotional excitement, and unrealised catecholamines begin to have a histotoxic effect. First of all, they affect the heart muscle and smooth muscle of the vascular wall, causing the development of micronecroses in the myocardium and heart rhythm disturbances. The neurosis of unreacted emotions may underlie the occurrence of necrosis of the heart muscle, atherosclerosis, hypertension, peptic ulcer disease, and mental health disorders.

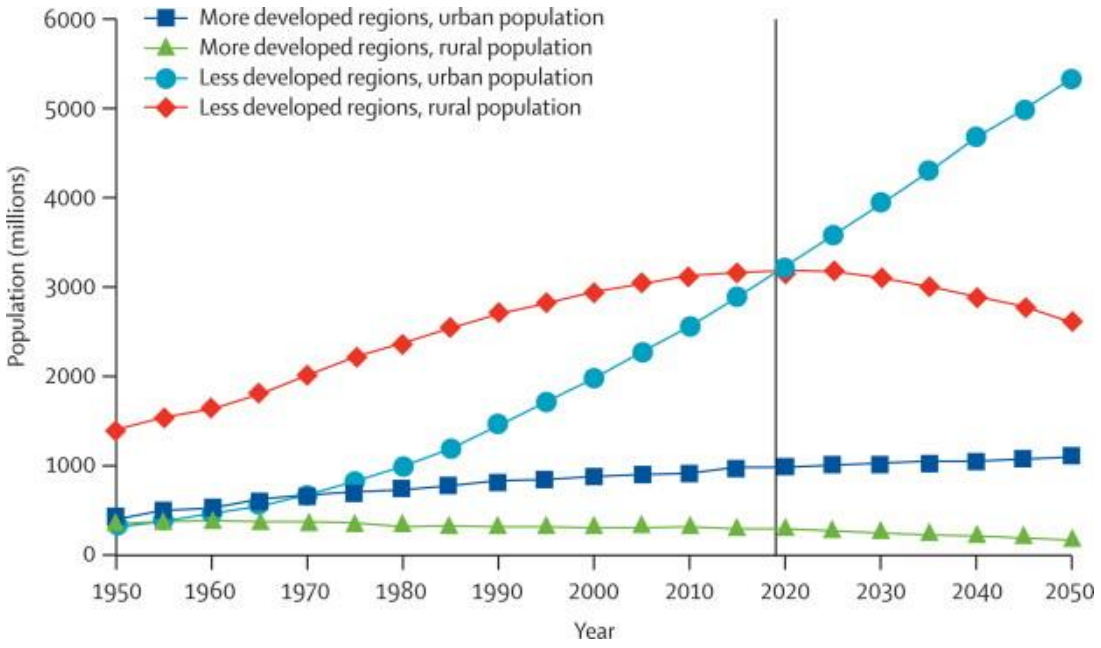


Figure 7.8. Evolution of urban and rural populations between 1950 and 2050

(Source: UN Population Division)

In the conditions of urbanised environment not only physical and mental health suffers, but also spirituality, morality of people, i.e., the very essence of a human being. Experiments with different animals have shown that the negative factors that distinguish the life of a big city give rise to neuroses and aggression. In nature, loud sounds are alarm signals, they lead the organism into a state of increased excitability. Crowding causes mental discomfort, and so does isolation.

The paradox of urbanisation is a crowded society that neglects the need for distance and isolation inherent in all living creatures, yet it is one in which the isolation of the individual is increasing, causing many city dwellers to feel empty and alone.

Among new buildings, wide highways a person feels depressed, as he is not able to cover the surrounding with his eyes, and the space visible to the eye horizontally and vertically, plays a determining role in his perception of the surrounding.

Sociologists believe that life in the modern big city has come close to the brink of madness. There are a growing number of signs of radical disadvantage, including increasingly widespread inertia, the desire to forget and escape reality with the help of various drugs and alcohol, and ever-increasing crime.

In all highly urbanised countries, there is a tendency for mental illnesses to increase. Alcoholism and drug addiction have become severe manifestations of "mental health" disorders of modern city dwellers, their inevitable companions are a sharp increase in the incidence of neuropsychiatric diseases, the growth of crime and the number of suicides. The highest percentage of drug addiction is among young people, which is usually explained by the disproportion between somatic and mental acceleration.

Overpopulation is one of the decisive factors in the emergence of mental illness and social pathology.

Human health depends on the quality of both natural and anthropogenic environment. In the conditions of a large city, the influence of the natural component on a person is weakened, while the effect of anthropogenic factors is sharply intensified. Cities, in which a large number of people, motor vehicles and various enterprises are concentrated on relatively small territories, are centres of technogenic impact on nature. Gas and dust emissions: industrial enterprises, their discharge of wastewater into the surrounding water bodies, municipal and household waste of a large city pollute the environment with a variety of chemical elements.

In most industrial dusts and wastes the content of such elements as mercury, lead, cadmium, zinc, tin, copper, wolfram, antimony, bismuth, etc. is hundreds, thousands and tens of thousands times higher than in natural soils.

The multidirectional effect of factors of different intensity on humans has been noted. A large degree of air pollution causes retardation of growth and development processes, growth of disharmony due to increased fat deposition, and low concentrations of harmful substances activate acceleration processes.

Comparison of anthropometric data in children showed that height, body weight and chest circumference in the area with polluted air are larger than in areas with a lower degree of pollution.

Such a phenomenon indicates the possibility of stimulation of physical development by exposure to unfavourable external factors of low intensity (height and body weight reach the highest values in areas with an average degree of pollution).

However, this acceleration of physical development is accompanied by a marked weakening of cardiovascular efficiency.

The environment is a complex system. It includes not only air, soil and water. Noise also plays a significant role in human life, especially in large cities.

The negative impact of noise on the central nervous system, autonomic reactions, blood pressure, activity of internal organs has been proved.

It is assumed that disturbance of nervous system functions under noise exposure is associated with metabolic shifts in nervous tissue. The brain - an organ of high physiological activity - is very sensitive to oxygen deprivation. When exposed to noise, brain hypoxia develops, as noise increases the tone of cerebral vessels, reduces blood filling of its tissues, which is a consequence of changes in the state of the vasomotor centre in response to noise irritation.

Vegetative reactions accompanied by deterioration of blood circulation of various organs, cardiac dysfunction, changes in blood pressure. They are especially pronounced at noise exposure of 65 - 95 dB.

Therefore, urbanisation has an ambiguous effect on human society: on the one hand, the city provides a number of socio-economic, social and cultural advantages, which positively affects human intellectual development and gives an opportunity for better realisation of professional and creative abilities; on the other hand, human beings are alienated from nature and get into an environment with harmful effects - polluted air, noise and vibration, limited living space, complicated supply system, dependence on trans-regional transport, etc.

The situation is aggravated by the fact that giant cities developed spontaneously and, as a rule, without taking into account the biological needs and psychological characteristics of human beings.

The problems associated with urbanisation need to be addressed not by individual private measures, seeking hasty and ineffective solutions, but by developing a set of interrelated social, environmental, technical and other measures. In all cases, human beings and the environment must be considered as a whole.

7.4 Ecological and economic problems of urban areas in Ukraine

The aggravation of regional environmental problems is significantly influenced by the processes of urbanisation, that is, the growth of the number and density of urban settlement.

The city is an anthropogenic ecosystem, which is a place of compact human habitation, production and household buildings, separated by a conventional border from the external environment.

Ukraine has 461 cities (as of 1 January 2019) and more than 880 urban-type settlements, where a significant part of industrial enterprises (more than 80%), forming the main technogenic load on the environment, are located.

Thus, in accordance with national statistics, up to 90% of various types of waste are generated in cities and just 10% in rural areas.

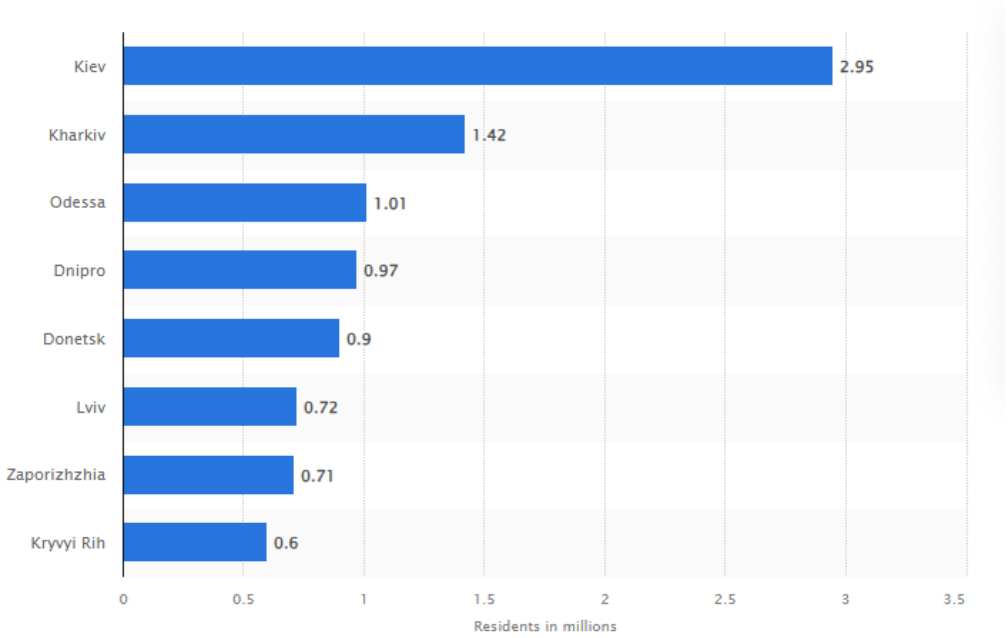


Figure 7.9. Ukraine: The largest cities in 2022, based on the number of inhabitants (in millions)

(Source: https://www.statista.com/statistics/424989/largest-cities-in-ukraine/)

Ukraine has a high percentage of small and mid-sized towns as it is shown in Fig.7.10.

A city is characterised by considerable human socio-economic activity. Consequently, the urban or urbanised environment is a special human habitat containing natural and man-made (artificial) components, as well as people and their social groups.

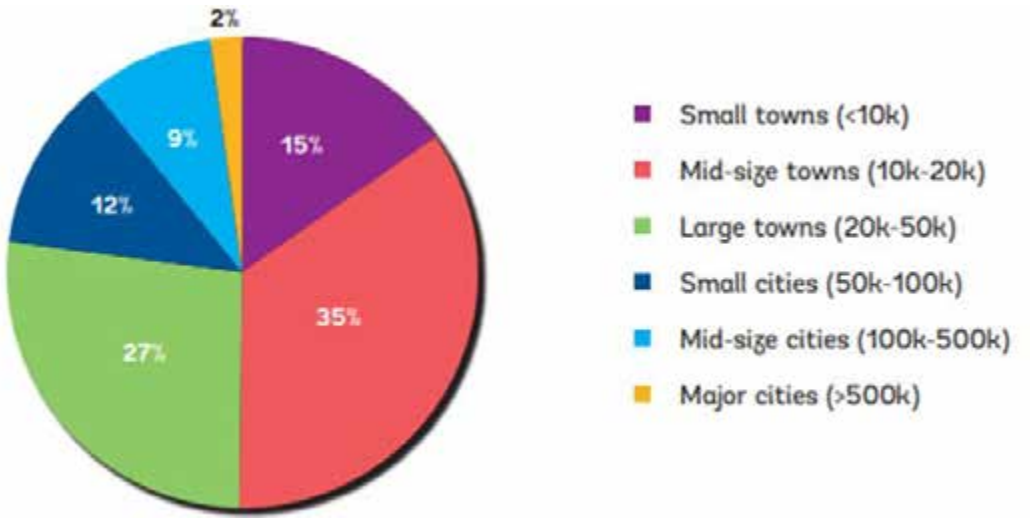


Figure 7.10. Percentage of cities in each category

(Source: Ukraine Statistics Department)

The natural components of a city are represented by the physical environment (air, water, and geological) and living organisms (except for humans). Artificial components are physical or spiritual objects that are the result of human activity: artificial, technogenic and spiritually-cultural environment objects.

People make up the social and psychological environment - gender, age, psychological, social, professional and ethnocultural groups. Therefore, a city is an urban geosocio-system or, in short, an urban system.

The proportion of people living in a city in a state or region is an index of urbanisation of that area. Currently, one in three people in Ukraine live in cities.

Cities are *open systems* where individual elements are not only connected to each other, but also to the environment. This connection is made through the flow of energy, matter and information.

As a result of the functioning of urban systems, material and spiritual goods are produced and, consequently, the environment is polluted by emissions and discharges of hazardous substances, as well as industrial and household waste.

The city is a *complex system* that consists of an urban ecosystem (the natural ecosystem of urbanised areas modified by humans), a social subsystem (the city's sociosphere) and the city's technosphere (the industrial and economic complex).

The peculiarities of the present stage of socio-economic and technogenic development cause a rapid growth of the urban population. Today, large cities are home to production facilities of machine-building, metallurgical, chemical, petrochemical, processing, defence and other enterprises that are sources of anthropogenic environmental impact.

Common criteria for assessing the degree of anthropogenic impact on the environment in large cities may consider the following:

- the size of the city;
- the size and density of the population;
- multistory and density of buildings;
- functionality of the territory use;
- areas of green and open spaces;
- industrial and economic specialisation;
- level of engineering infrastructure provision.

A great number of people in cities are in need of employment, comfortable housing, recreation facilities, as well as watering, feeding, and waste disposal. Moreover, the higher the level of development of scientific and technological progress, the more comfortable the living conditions of the population, the greater the negative impact on the environment.

For the city to function properly, it needs a large mass of different products and raw materials, as well as clean water. The millionaire city consumes 470 million tonnes of water per year (or almost 0.5 cubic kilometres). Most of this water leaves the city and flows into natural watercourses, but in the form of wastewater polluted with various contaminants. The use of surface water within the city is mainly for household needs.

In recent decades, the water supply has been facing a shortage of water resources of the required quality, which necessitates transporting water for tens or even hundreds of kilometres. Additionally, the deterioration and sanitary condition of water supply systems in several Ukrainian cities has reached a critical level.

Figure 7.11. Volumes of polluted (polluted without treatment and insufficiently treated) wastewater discharged into water bodies in Ukraine, million cubic metres

(Source: https://sdg.ukrstat.gov.ua/uk/6-3-1/)

Industrial wastewater discharges are the most significant source of water pollution. In recent years, Ukraine's environmental policy has been aimed at limiting the discharge of industrial wastewater into water bodies, up to and including a ban on the discharge of untreated wastewater within the city limits.

Air pollution is an equally significant environmental problem in urbanised areas. The main sources of air emissions are the technological processes of the following industries: heat and power, mining, construction, chemical and petrochemical, ferrous and non-ferrous metallurgy, machine building, and transport.

One of the characteristic features of urban areas with developed industry is smog, an atmospheric phenomenon that occurs when certain meteorological factors and significant air pollution coincide.

Air protection measures include architectural and planning solutions, which include the selection of a site for the construction of an industrial enterprise, considering the location of wind rose, residential areas, and green areas.

Engineering and organisational measures are taken to reduce the intensity and organise traffic (construction of bypass roads near cities, road junctions at different levels, organisation of traffic on motorways using the "green wave" system), increase the height of pipes, etc.

Solid waste generation is an important problem for large cities. Its volume depends on the improvement of the housing stock, the length of the heating season, the number of storeys, and the welfare of the population (the higher the welfare, the more waste is generated per capita).

Figure 7.12. Amount of waste generated by all types of economic activity per unit of GDP, kg per 1000 USD at 2011 parity purchasing power

(Source: https://sdg.ukrstat.gov.ua/uk/12-4-1/)

In Ukraine, solid waste is collected without separation into separate components (gross collection). In the developed world, separate or selective

collection of individual waste components is common, which significantly reduces the amount of waste disposed of to dumps and landfills.

In recent years, the destruction and recycling of solid waste at waste processing and incineration plants has become widespread around the world. Ukraine has developed a large number of industrial waste disposal technologies for various sectors of the economy, but their introduction is hampered by a lack of funds at enterprises and low demand for the products they produce.

Self-control questions to Topic 7:

1. A social science that studies the population and patterns of its development is called … (fill in the omitted word)

2. How can you describe in a few words the socio-demographic situation in Ukraine?

3. In 2020, the total birth rate in Ukraine was:

a. 1.4 children per woman;

b. 1.8 children per woman;

c. 2.1 children per woman.

4. Does family in modern Ukraine continue to perform its specific functions for supporting physical and socio-cultural replacement of generations?

5. What is the ratio between rural and urban population at these days?

6. What is the most important thing for the internal unity of ethnos?

7. The earliest self-name of our country was:

a. Ukraine-Rus';

b. Rus';

c. Ukraine;

d. Little Rus'.

8. The Ukrainian ethnic group consists of:

a. the main ethnic massif of the Ukrainian people, which basically coincides with the territory of its formation

b. the diaspora

c. some communities among Ukrainians, distinguished by specific cultural features

d. all the above answers are correct

9. Have socio-economic conditions become decisive factors that determined the formation of the modern face of the Ukrainian nation?

10. What is a city? Give an appropriate definition.

11. How many different types of waste are generated in cities according to national statistics?

a. up to 100%;

b. up to 10%;

c. up to 90%.

12. The natural components of the city are represented by physical or spiritual objects that are the result of human activity. (yes or no)

13. The urbanization of certain territory is:

a. proportion of people living in the cities of the country or region;

b. location a significant part of industrial enterprises;

c. natural and geographical conditions.

14. What are features of the current stage of socio-economic and technogenic development in the context of urbanisation?

Section 8.
CONCEPTS AND PERSPECTIVES FOR THE DEVELOPMENT OF THE NATURE-SOCIETY SYSTEM

8.1 The concept of the noosphere and ways of humankind's development

Today, the development of society under the impact of scientific and technological progress is nearly 100,000 times more rapid than the rate of change in natural ecosystems in the course of biological evolution. The total energy consumption of one person today has increased by about 5,000 times compared to that at the beginning of civilisation. Human influence has extended to outer space, and the scope of activities within the Earth's surface has reached geological scales.

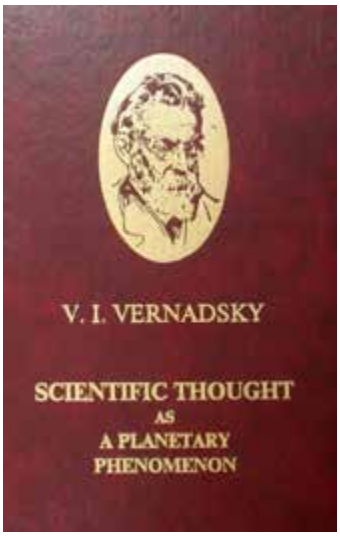
The multiple growth of the anthropogenic pressure has resulted in the uncontrolled development of irreversible processes of the degradation of ecosystems, the development of hazardous environmental crises and threats to the existence of civilization and humans as a biological species.

In *the Biosphere*, a system where balanced biochemical, geophysical and geochemical processes of self-regulation, self-purification and self-restoration were formed in the course of a long (millions of years) development, the technosphere appeared as a subsystem created by humans, which very quickly switched to itself the energy flows necessary for many other subsystems, and this brought them irreparable harm.

In *the Technosphere*, economic and technological progress has begun to change the direction of evolutionary processes. This subsystem develops in an aggressive manner, without any coordinating feedbacks and consideration of ecological laws, develops according to the scheme of an amplifier rather than a compensator, and is oriented towards economic growth rather than balanced development.

Currently, ethics and morality do not contribute to the environmentally and economically balanced development of civilisation and the healthy functioning of

the biosphere, but are aimed at creating more and more efficient technologies for the use of all kinds of natural resources and their careless depletion, while generating waste that is unacceptable for the biosphere.



According to academician Vernadsky, the next stage in the development of the biosphere should be the Noosphere. He stated that "the Noosphere is a new geological phenomenon on our planet. It is the first time that humanity has become the greatest geological force. It can and should rebuild the sphere of its life with its labour and thought, rebuild it radically compared to what it was before... We are entering the Noosphere. We are entering it - into a new spontaneous geological process... But it is important for us that the ideals of our democracy are in unison with the spontaneous geological process, the law of nature, and are in line with the Noosphere. Therefore, we can look to our future confidently...".

International science has explicitly and clearly recognised that human activity should be based on the necessity of harmony in the interaction between the environment, society and economy. Humankind is becoming increasingly aware of the need to establish a balanced relationship between humans and the environment. These relationships define the future wellbeing, safety and, ultimately, the survival of humanity as a biological species. Almost no one has any doubts that plants, animals, minerals, energy and other resources can't be taken and used by humankind faster than they are renewed in the biosphere.

In 1986, the well-known American ecologist Eugene Odum argued that, despite the enormous capabilities and abilities of the human mind and the capability to manage natural processes, it is too early to talk about noosphere genesis, as humans are not yet able to foresee all the effects of their actions. Currently, three scenarios for the future development of humanity are considered the most realistic:

1. The inertial scenario, i.e., development "as usual", is a chaotic, uncontrolled development process in which the observed tendencies continue: environmental degradation, although somewhat slowed down by the use of more advanced technologies for the exploitation of natural resources, the dominance of economic criterions, national egoism, lack of consciousness, inability to attempt adequate action, and underestimation of signals from the destroying biosphere.

2. The ultra-totalitarian scenario is an absolute world dictatorship (possibly bi- or tri-polar) both in relation to the "third world" and to its own population, a continuous competition for resources, wars, and ruthless social and biological eugenics.

3. Transformational scenario - a quick awareness of the dangers associated with environmental destruction, an appropriate response to the socio-ecological crisis, a breakthrough to a new understanding of the world and a new value system based on collective global action.

The main published scenarios of the development of humanity, as well as its current development, are mostly corresponding to the first scenario, which directly leads to an environmental catastrophe. If the signs of environmental catastrophe become more serious (as catastrophic climate change is already occurring), the first scenario may turn into the second. But neither the first nor the second scenario is relevant to sustainable development.

8.2 Theory of biotic regulation and environmental stabilisation

The author of the theory of biotic regulation and environmental stabilisation is biophysicist V. Gorshkov, whose significant achievement in scientific research is also the setting of the limits of biosphere sustainability (the criterion of sustainability, stability of the biosphere) in relation to anthropogenic pressures.

This criterion defines the carrying or economic capacity of the biosphere, which is about 1% of the net primary production of biota globally, which is about $23*10^{18}$ J/year, or, in terms of power, 0.74 TW or 0.74 10^{12} W.

It is estimated by various experts that the current direct consumption of biological products by humankind ranges from 7 to 12%, or ten times higher than the biosphere's sustainability limit. The gross energy capacity of our civilisation is about 18 TW, that is, 24 times more than the energy estimate of the limit.

The only lesson from these calculations is that the anthropogenic impact on the biosphere must be reduced immediately. The most important ways to reduce this tension are to decrease the world's population, to make the economy and all spheres of production more environmentally friendly, and to recover natural ecosystems.

The scientific concept of biotic regulation of the environment was developed by Prof. Gorshkov in the format of the next main provisions:

- An environment that is suitable for human life is created and sustainably maintained in an optimal state by natural communities of living organisms (biota) that are not disturbed by humans. Only to a certain threshold does the natural biota cover the disturbance of the optimal condition of the environment, including anthropogenic disturbances. Biotic regulation occurs on both local and global scales.
- Biotic regulation is achieved through the coordinated functioning ("work") of living organisms of all species that make up an ecological community. The information required for this work is included in the genomes of natural species. The stabilising process of natural selection prevents the decay of this information. Evolution is moving in the direction of strengthening the regulatory potential of the natural ecological community.
- The quantity of flows of information processed by natural biota in the course of environmental control is twenty orders of magnitude greater than the quantity of information flows that can be processed by present-day civilisation. There is no technical analogue to biotic regulation.
- The destruction of natural ecosystems in the process of human economic activities leads to the degradation of the biotic regulation mechanism on a local level and the continuous reduction of its global capacity. Neither artificial nor human-disturbed biological systems (such as fields, pastures, or exploited

forests) are capable of maintaining the environment in a sustainable way. Instead, such systems operate as powerful destabilisers.

- The environment and climate parameters suitable for human life are physically volatile. The liquid state of the hydrosphere, that is the basis for the functioning of living systems, is physically not stable in terms of transition to the status of total glaciation of the planet or total evaporation of the oceans. Without biotic management, the Earth's environment and climate will become uninhabitable for human life in a short time.
- The principal task of modern science is to estimate the amount of land that should be withdrawn from economic activity on a global level and returned to undisturbed natural ecological communities for the purpose of preventing a global environmental crisis and restoring the long-term sustainability of the Earth's habitable environment and climate.

It means that the theory of biotic regulation and stabilisation of the environment claims that without natural ecosystems, human existence on Earth is impossible.

8.3 Theories of symbiotic path of development, concepts of co-evolution and energy of progress by Mykola Rudenko

Authors of the *symbiotic path of development*, based on the historical experience of humankind, from ancient times (Egypt, Mesopotamia, Colchis farmers, Israel, as well as V. Dokuchaev's experiments) to the current days (the Netherlands) and relying on the latest achievements and capabilities of science and technology (restoration of low-value lands with the help of the newest technologies), have proposed to solve the problems of bioresources and mitigate the anthropogenic pressure on the biosphere by constructing complex symbiotic systems.

These scientists (I. Gitelzon at al.) argue that the experience of developing closed life support systems indicates that with effective and correct organisation of

the economy (all land under farming, using of drip irrigation, and so on), about 50 billion people can survive on Earth, but it is better not to get to that limit.

Scientists have tried to prove that population growth does not threaten the global ecological equilibrium: if a country is fully supplied with food, the problem of overpopulation does not arise, because the cultivation of agricultural land generates just as much oxygen as is then used for breathing. They also believed that if environmentally friendly production technologies were developed, their broad use in developing countries would not worsen the ecological state of the planet.

The main emphasis of the symbiotic path of development is placed on the improvement and widespread use of new effective resource conservation technologies, when, without restraining economic growth, the complex environmental value of territories is increasing artificially (soil fertility, biomass of water areas, forests and meadows are increasing, the amount of waste is decreasing, special services are being created - international flotillas and mechanised units for the purification of oceans and large areas of land, programmes for optimising biosphere cleaning technologies based on full transparency of environmental information are being developed at the international level, etc.).

According to V. Shevchuk and G. Bilyavsky, the symbiotic path of development can only partially solve the issue of human survival, as the main focus is on the problem of resource depletion and does not address a number of other issues: biodiversity loss, demographic growth, technologies for purifying the biosphere from waste, ways to ecologise the economy, etc.

According to the author of *the concept of co-evolution*, M. Moiseev (1998), the programme of "sustainable development" should be the first step towards the implementation of the fundamental axiom of the future existence of humanity - the axiom of the need to ensure the co-evolution of humans and the biosphere.

If the axiom of co-evolution is accepted on a merely intuitive level, without a detailed interpretation of its biological and social content, it leads to the necessity of

at least two forms of action that are obvious but, unfortunately, have not been implemented so far.

First of all, it means adherence to the principle of natural rationality, i.e., organising society's life in a way that is in line with the life of Nature. Realization of the principle of natural rationality demands at least two complex and extremely significant actions: 1) a perspective scheme of megacity development must be drawn up and the relevant rules of life must be formulated; 2) It must understand the basic principle and unacceptability of its violation - the principle of joint development of nature and society.

Secondly, education. It is necessary to ensure a qualitatively new level of environmental education, especially for those who hold public office or are about to hold such positions.

It is no less important to ensure that secondary school teachers, school principals and heads of higher education institutions have the appropriate level of environmental knowledge.

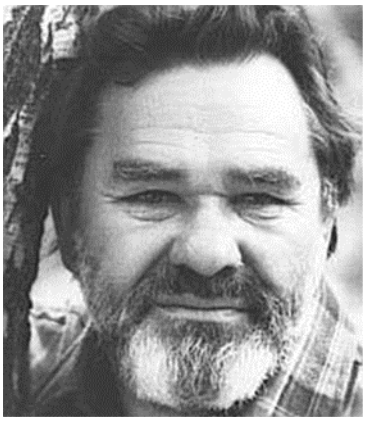
Finally, mass public education is needed. People should not only know the ecological features of their home (in other words, the features and laws of the development of the biosphere), but also be able to live in this home in compliance with ecological laws, i.e., in accordance with the principles of co-evolution with natural ecosystems.

The ideas of Mykola Rudenko, a Ukrainian scientist, writer and public figure, are briefly outlined in his work "The Energy of Progress".

His main point is that only farming can bring real profit. His main point is that only farming can bring real profit. And "in order to prevent the land from being depleted and the peasant from becoming poor, the five conventional units of production must be distributed as follows: 2 units (straw) for livestock and soil, the other three (grain) for the peasant, industry and the country".

Especially actual in the context of using straw as an energetic raw material is M. Rudenko's opinion that "it is senseless to create values from non-living matter (for example, buildings) by breaking living matter (organic matter)".

No less relevant are the following theses:


Mykola Rudenko

• humankind lives on solar energy, and the analysis of socio-economic development of society should begin not with labour, but with the energy that provides this labour; from the absolutisation of labour, we need to move to the absolutisation of space energy;

The theory of the solar nature of surplus value was developed more than a hundred years ago in Ukraine by Serhiy Podolynsky. Interestingly, V.I. Vernadsky claimed that it was Serhiy Podolynsky who helped him understand the solar origin of the earth's civilisation.

• humanity in its life on earth is a solar energy transformer, and this energy must be divided into two parts: the one that enters the world annually in the form of grain, fruits and vegetables, and the other part that is stored in underground deposits of coal, oil, gas, shale, and so forth;

• absolute surplus value is the portion of the harvest that the peasant takes to the market; it is through this absolute surplus value the cities and civilisation grew and developed; everything starts with the field, photosynthesis and a grain, and finishes with different industrial goods, money, and so on;

• it is only agriculture that has the ability to generate new matter, while industry, under any conditions, generates only new form and produces only relative surplus value;

• absolute surplus value is equated with the energy of progress; relative surplus value is invariably entropic - it doesn't accumulate solar energy on the Earth, but uses it up (underground solar energy reserves are depleted, photosynthetic products

are consumed, and the land is exhausted); all empires have perished from land depletion;

• if we don't leave the farmers with their products and create them normal living and working conditions, we will never get out of the ecological and economic crisis;

• all harvest should belong to those who produce it;

• the energy of progress emerges when the products received by peasants are distributed according to the scheme: 20% to the peasants, 20% to the livestock, 20% to the soil, and 40% to industry and the country through the money and market; here, money acts as a measuring instrument for the solar energy that circulates in the economy;

• if we build a state in accordance with the laws of Nature, then all that is cultivated in the fields should be left to the farmers; to grow a new awareness on the basis of the highlighted ideas (cosmic awareness), one has to bind one's soul to the Universe, one has to work for the Universe;

• a major role in the formation of a new awareness should be played by the national intelligentsia and the church; they should help all people recognize and follow the higher laws of Nature;

• wealth is born out of freedom; absence of freedom leads to a totalitarian state;

• agriculture should always be given priority in society; the reason for the demise of the former soviet empire was the kolhosp system, where almost 90% of agricultural enterprises were unprofitable.

8.4 The concept of sustainable development as an opportunity to harmonise the Nature-Society system

The size and scope of human activity has grown at an exponential rate since the mid-20th century. Scientists believe that we have moved from the Holocene into a new geological era. Consequently, nature and the ecosystem services it provides to

humankind are at increasing risk. In order to draw attention to our potentially dangerous ecological situation, Paul Krutzen, a Nobel Prize winner, and others have hypothesized that we have moved from the Holocene into a new geological era, dubbing it the *Anthropocene*.

Throughout the Anthropocene, the climate is rapidly changing, as oceans acidify and entire biomes become extinct - all at a speed that can be measured in a normal human lifetime. For many living organisms, the future is now in doubt. And not only wild plants and animals are at risk: humans are increasingly becoming victims of environmental degradation.

Climatic and other forecasting models show that without any action during the Anthropocene, the planet will become far less hospitable to our present globalized community.

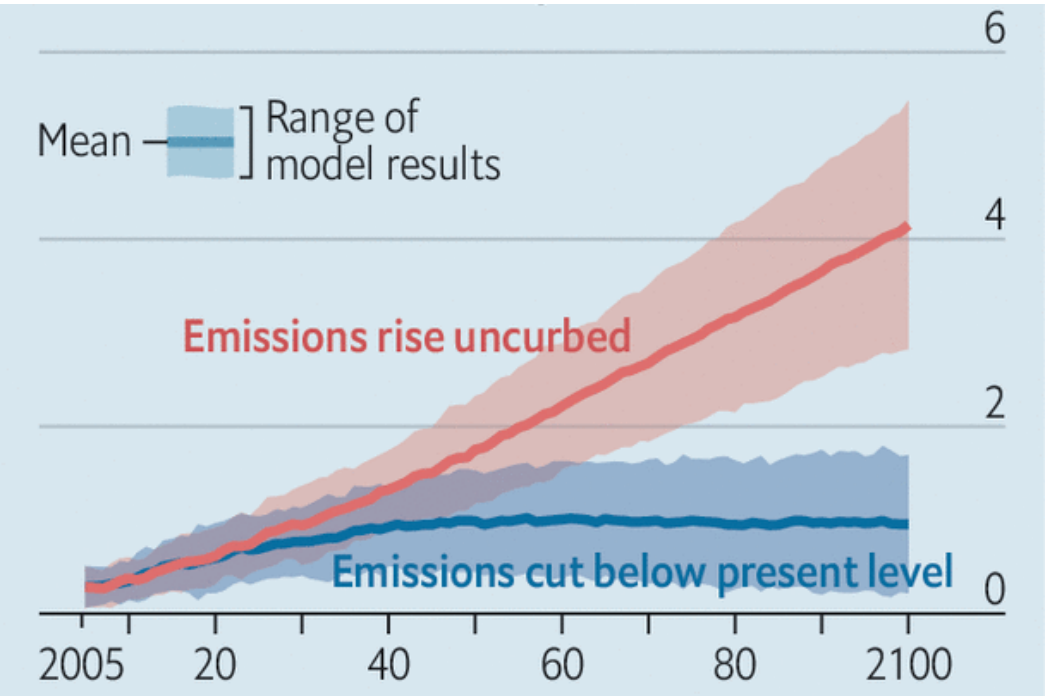


Figure 8.1. Global average surface temperature change (relative to 1986-2005 average, ^{0}C)

(Source: IPCC)

In light of our existing trajectory to the unacceptable conditions foreseen for the Anthropocene, humanity faces an obvious challenge to learn how to work within the ecological limits of our Earth and how to maintain or recover ecosystem resilience.

Throughout human history, nature's ability to cope with the impact of human development has been limited. In ancient times, pollution and other types of pressure led mainly to the deterioration of the local environment. However, we have now stretched the limits of natural resistance at the global level. World population has increased from about 1.6 billion people in 1900 to nearly 8 billion today. Over this period, both technological innovation and the use of fossil fuels have helped to meet the rising demand for resources.

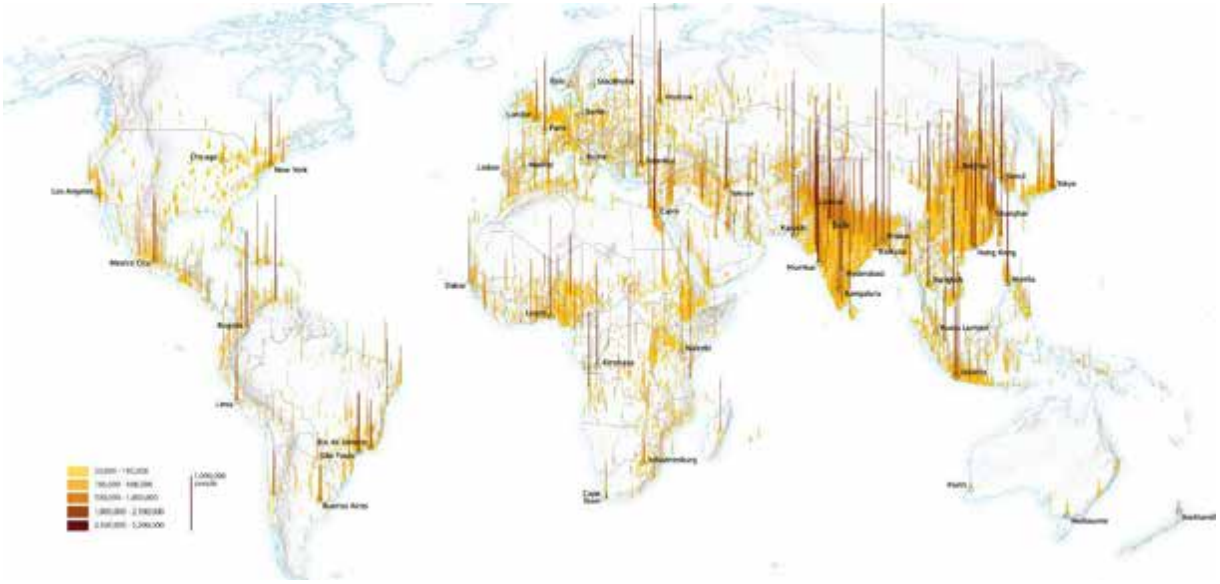


Figure 8.2. Concentrations of population distribution across the world

(Source: Atlas of the Human Planet, 2016)

In particular, in the early 1900s, an industrial method of fixing nitrogen into ammonia was created. Today, the obtained synthetic fertilizers support nearly half of the global population, however, they contribute to pollution of air, water, and soil. Easily accessible fossil fuels are providing energy for consumer needs and industrial

production, which allows for international trade. However, this comes at the cost of increasing CO_2 concentrations in the atmosphere and contributing to global warming.

People's activities and the accompanying use of resources have increased so significantly, in particular since the mid-20th century, that the ecological conditions that have contributed to our development and rise are beginning to degrade. Obviously, responding to planetary-scale risks will be far more complex than anything we have ever faced before.

Looking at the Earth as a single system can help us understand the complex interconnections between human actions and global influences that affect the natural conditions of the planet. It allows us to understand how local changes have effects that show up at other geographical scales, and to realize that an action affecting one system can affect other systems too.

The concept of planetary boundaries is an example of this view of the Earth system. This concept demonstrates how global production and consumption patterns cause increased risks to both natural and social systems.

Planetary boundaries is a concept that includes Earth system processes that contain environmental boundaries, proposed in 2009 by an Earth system group and environmental scientists led by Johan Rockström of the Stockholm Resilience Center and Will Steffen of the Australian National University.

Planetary boundaries define, as it were, the boundaries of the "planetary playing field" for humanity if major human-induced environmental change on a global scale is to be avoided.

Nine human-produced alterations to the functioning of the Earth system form the basis of the Planetary Boundaries.

They are “1) biosphere integrity (or destruction of ecosystems and biodiversity), 2) climate change, and 3) its twin problem ocean acidification, 4) land-system change, 5) unsustainable freshwater use, 6) perturbation of biogeochemical

flows (nitrogen and phosphorus inputs to the biosphere), 7) alteration of atmospheric aerosols, 8) pollution by novel entities, 9) stratospheric ozone depletion".

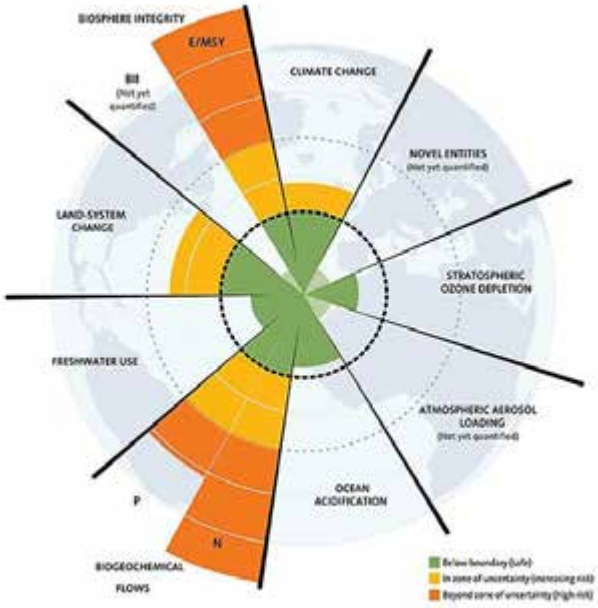


Figure 8.3. The planetary boundaries framework

(Source: J. Lokrantz/Azote based on Steffen et al. 2015)

The green zone is the safe operating space (below the boundary), yellow represents the zone of uncertainty, with an increasing risk of disrupting Earth system stability; and red is the high-risk zone, pushing the Earth system out of a stable Holocene-like state. The Planetary Boundary itself lies at the inner heavy circle.

Based on our evolving understanding of the functioning and resilience of the global ecosystem, the Planetary Boundaries framework delineates safe limits for the functioning of these critical Earth subsystems.

Within defined safe operating spaces human societies can develop and thrive. When we push beyond these boundaries, we risk causing irreversible changes to resources that we depend upon.

Although there is some degree of scientific uncertainty regarding the biophysical and societal effects of exceeding the boundaries, current analysis

suggests that humans have already pushed four of these systems beyond the limit of their safe operating space.

Attributable global impacts and associated risks to humans are already evident for climate change, biosphere integrity, biogeochemical flows and land-system change. The loss of biological diversity, fertilizer use, climate change and land use have now all gone beyond a point of ”safe operating”, increasing the risk of disrupting complex interactions between the land, ocean, atmosphere and people.

One thing is clear: we cannot tackle just one boundary without addressing the others. Changes in the Planetary Boundaries are not isolated from one another; changes in one can be amplified through changes to other boundary categories.

Today, more than ever, there is a clear necessity for a new "environmental morality," a new vision of the world for every person living on Earth. The new attitude towards nature grows out of the awareness that humanity has reached the last limit, and requires vigilance and responsibility. It becomes obvious that within the technocratic paradigm of development of society, overcoming the crisis of civilization is impossible. It is necessary to look for new conceptual approaches and new models of development.

The concept of sustainable development is an alternative to the economic growth paradigm, which ignores the environmental dangers from the development of society based on an extensive model.

The Stockholm Conference on the Human Environment brought together both industrially developed and developing countries for the first time to determine the human right to a viable and productive environment, discussed the regulation of the use of natural resources, the identification and control of the most important types of contamination, and launched international cooperation on environmental problems.

Among the most important outcomes of the Conference was the recommendation to recognize the human right to a healthy environment as a fundamental legal principle. The first principle of the Stockholm Declaration

provides: "Everyone has a fundamental right to freedom, equality and appropriate conditions of life within a natural environment whose quality allows for a life of in dignity and well-being."

The Declaration went on to solemnly proclaim the duty of governments to preserve and improve the environment for present and future generations. Following the Stockholm Conference, several countries have recognized in their constitutions or laws the right to an adequate natural environment and the obligation of the state to protect that environment.

Maurice Strong

At the Stockholm Conference, the term "eco-development" was first coined by Maurice Strong, a Canadian businessman who started his career as an entrepreneur in the Alberta oil patch and was president of the Power Corporation of Canada until 1966. In the early 1970s, he served as Secretary-General of the United Nations Conference on the Environment and then became the first Executive Director of the United Nations Environment Program (UNEP), then served as Commissioner of the World Commission on Environment and Development and was recognized by the International Union for Conservation of Nature as a leader of the international environmental movement. Eco-development is an environmentally oriented socio-economic development in which the improvement of people's well-being is not accompanied by the worsening of their habitat and degradation of natural systems.

The father of ecological economics (or sustainable development economics) can be considered the American economist Herman Daly, who outlined an ecological-economic way of thinking. While working at the World Bank, he helped develop policies regarding sustainable development. According to Herman Daly's

conclusions, the "growing economy" model should be replaced by a limited " steady-state economy" model.

The Daly "Triangle" depicts the human economy as resting on the foundation created by natural capital. Natural capital, including natural resources and ecosystem services, is the primary means of development.

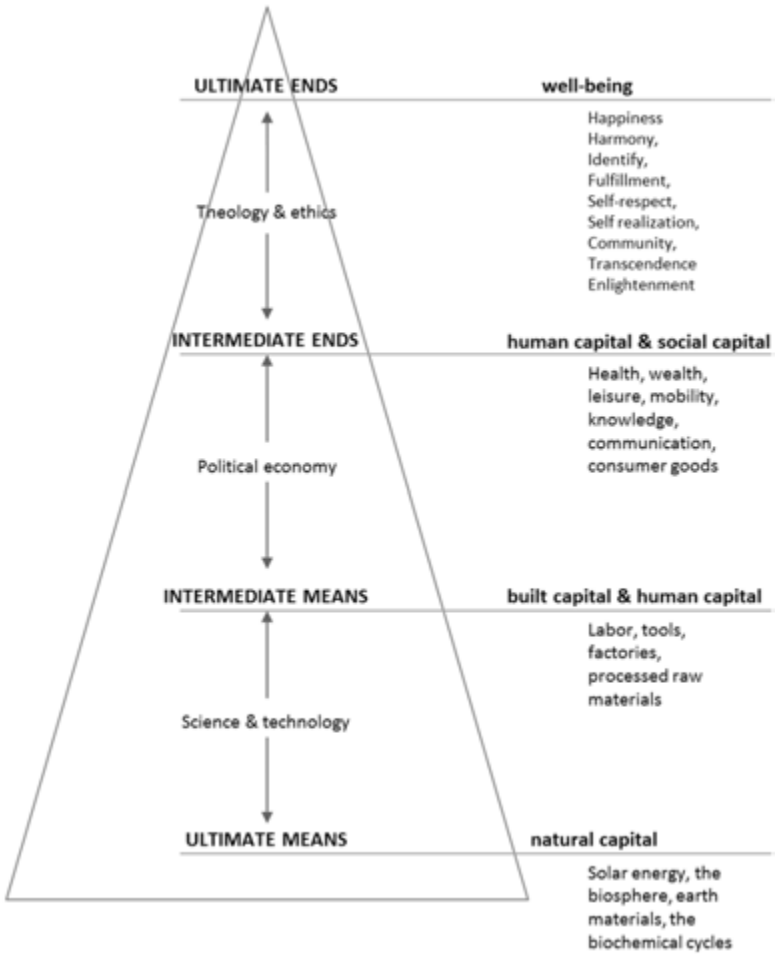


Figure 8.4. Daly Triangle (with Meadows Modification)

(Source: Sullivan, Robert at al., 2016)

It is impossible to build human societies and human well-being without these resources and services. Economy and technology are not goals in themselves, but intermediate means to achieve intermediate ends (including human and social

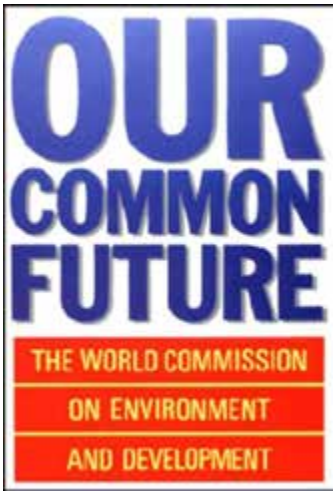
capital) and the ultimate goal, which is human well-being. This new theory is known as "steady state economics".

Daly notes that today's neoclassical economic theory starts with non-physical parameters (technology, preferences, and income distribution are assumed to be given) and investigates how to adjust physical variables, such as the quantity of goods produced and resources used, to match the equilibrium state (or equilibrium growth rate) determined by these non-physical parameters.

Thus, non-physical qualitative characteristics are given, while physical quantities are subject to adjustment. In neoclassical theory, this "adjustment" almost always involves growth.

However, the new paradigm that is emerging today (steady state, sustainable development) starts with physical parameters (limited environmental capacity, complex ecological relationships, laws of thermodynamics) and tries to figure out how to achieve a fair balance between non-physical variables (technologies, preferences, distribution, and lifestyles) and the complex biophysical system of which the biosphere is a part.

In this approach, physical quantitative parameters are given, and non-physical qualitative models of life become variables. This newer paradigm is more similar to classical than neoclassical economics, as the adjustment is made through qualitative development rather than quantitative growth.



In 1983, the United Nations launched the International Commission on Environment and Development to develop a global action program. In 1987, the Commission presented its report "Our Common Future" (Brundtland Report), in which it recognized humanity's dependence on the environment and defined sustainable development as “meeting the needs of the present without compromising the ability of future generations to meet their own needs”.

But it was only in 1992, at the UN International Conference on Environment and Development in Rio de Janeiro, that the idea formulated in the report Our Common Future received official acceptance.

The convening of this summit was significant in itself - a crucial step was taken towards a general revision of the foundations of our civilisation, towards the birth of a future global development strategy. And it was awaited by the entire scientific community, by all those who dealt with environmental issues.

Such a congress was not only necessary, but also significantly overdue. However, the congress did not meet the expectations of scientists; it could not rise to a sufficiently high scientific level. And, even more importantly, it did not dare to face the truth: the perceptions of modern politicians were still shackled by traditional templates. The purely mercantile and political interests of representatives of the most developed countries, especially the United States, which was the main consumer of resources and polluter of the planet, and a country for which the change of modern civilisation paradigms would be particularly difficult, prevented them from refusing them.

Instead, the principle of "Sustainable development" was declared, which asserted the inadmissibility of unlimited and uncontrolled use of resources and pollution of the biosphere, which in itself, of course, is to be welcomed! But to confine oneself to such a declaration in the current circumstances is extremely insufficient and dangerous!

The conclusion of the congress was unfortunate for another reason: the principle of "Sustainable development" was presented in such a way that the world community perceived the task of implementing this principle as a kind of absolute panacea - the idea was born that humanity already has a recipe for overcoming the

environmental crisis and knows the way out on a trajectory of prosperous development. And the level of emotional stress in society related to the deterioration of the environmental situation has significantly decreased.

The phrase "Sustainable development" is difficult to translate into Ukrainian in a short sentence - it means development that is acceptable or coordinated with the state of Nature and its laws (literally, it is long-term development, that is, the development of society that can last for as long as it wants).

In any case, its authors (an international commission chaired by Madame Gro Harlem Brutland) had this meaning in mind. In Ukraine, it has been translated as "stiykyy" or "stalyy rozvytok". Moreover, a state concept of sustainable development (stalyy rozvytok) has even appeared. This translation of the term "Sustainable development" is a bit of linguistic nonsense, because there simply cannot be stable development - if there is development, there is no stability.

Despite all the above, the term "sustainable development" ("stalyy rozvytok") has become not only commonplace, but also part of government documents.

Among the main provisions of the concept of sustainable development is the fact that humanity is able to make the development of world civilisation sustainable and durable so that it meets the needs of people living today and does not deprive future generations of this. On its basis, concepts of sustainable development have been developed and are being implemented in a number of countries.

Most modern scientists and politicians consider the Concept of Sustainable Development to be the most promising ideology of the 21st century and even the entire third millennium, which, with deepening scientific evidence, will replace all existing worldview ideologies as fragmentary and unable to ensure the long-term development of civilisation.

Considering the cause-and-effect relationships, the general goal of the sustainable development strategy is to preserve mankind, and the primary objective is to maintain the conditions under which mankind can exist and develop, in other words, to maintain the sustainability of the biosphere and local ecosystems.

The key objective of the sustainable development strategy is to maintain the conditions for stable development of the social, economic and environmental components of the society-biosphere system by forming conditions for balanced nature management.

There is no doubt that the concept of sustainable development is more important today than ever, and that living within our ecological limits is a fundamental part of this development. A sustainable world is also a world where societies are strong and just, and where everyone has the chance to live a full life with equal opportunities.

At the Millennium Summit in September 2000, UN member states reaffirmed that their top priority remains the eradication of poverty and support for the development of all countries. The Millennium Development Goals focus on achieving significant improvements in people's lives. They established a set of criteria for measuring results that help finance development programmes.

The Millennium Declaration contains a separate section on environmental protection, with reference to biodiversity loss, climate change, desertification, and water and forest management. Environmental sustainability objectives are one of the main areas of environmental protection in policies and programmes, as well as reducing the loss of resources and improving access to environmental services.

Millennium Development Goals (MDGs) 2000 - 2015

Ukraine has adopted the universally recognised Millennium Development Goals (MDGs) in 2000 together with 189 other countries and has made a political commitment to achieve them and their targets by 2015.

The Millennium Development Goals for Ukraine have been divided into seven priority sectors: poverty reduction, access to quality education across the life course, promoting gender equality, decreasing child mortality, enhancing maternal health, decreasing the spread of HIV/AIDS and tuberculosis, and maintaining environmental sustainability.

On 22 June 2012, heads of state and government agreed on the outcome document of the Rio+20 UN Conference: The Future We Want. This final document confirmed the commitment to the goal adopted at the World Summit on Sustainable Development in 2002: a course aimed at sustainable development and at ensuring an economically, socially and ecologically balanced future for our world, for present and future generations.

The document confirms the necessity of further promoting the idea of sustainable development at all levels and integration of its economic, social and environmental components as well as taking into account their interrelation.

The 2030 Development Agenda was adopted by world leaders at the UN General Assembly Summit in September 2015. It is a global agreement on the transition to a new development paradigm, in accordance with which the achievement of economic progress should be aligned with other aspirations - social justice and environmental sustainability worldwide.

This document calls for fundamental changes in the way we produce and consume, and for new models of behaviour in our relationship with nature and within society. It also calls for new, more efficient, effective and innovative mechanisms to address emerging challenges and threats.

The 2030 Agenda is based on the following core values:

- dignity - eradicating poverty, combating inequalities and protecting the rights of everyone, including all those who remain in difficult situations;

- people - providing healthy lives, knowledge and inclusion of women and children;

- planet - protection of ecosystems for present and future generations;

- partnership - strengthening solidarity for sustainable development;

- justice - encouraging communities to exist in peace and security and with strong institutions;

- prosperity - developing a prosperous and transformational economy.

The summit's final document, "Transforming Our World: The 2030 Agenda for Sustainable Development", defined 17 Sustainable Development Goals (SDGs) and 169 corresponding targets.

Figure 8.5. Sustainable Development Goals (2015-2030)

Along with other UN member states, Ukraine has joined the global process of implementing the Sustainable Development Goals. In 2016-2017, the process of adapting the Sustainable Development Goals to the Ukrainian context continued. The result of this process was a national system consisting of 86 national development goals.

The National Report (2017) shows that Ukraine is among the countries with complicated environmental problems.

On the one hand, they are typical for developing countries (uncontrolled use and misuse of natural resources), and on the other hand, they are typical for industrialized countries (industrial contamination).

The report emphasised that waste management is a significant issue in the period of transformation. It was stated that the amount of waste generated is constantly increasing, while the percentage of recycled waste remains insignificant. For example, according to the company Recycling Solutions (2021), no more than 20% of the over 400 million tonnes of waste per year in Ukraine is recycled. At the same time, the share of municipal solid waste is only about 3% of the total.

Figure 8.6. The largest landfills in Ukraine

(Source: https://ns-plus.com.ua/2017/08/15/tonemo-problema-pobutovyh-vidhodiv-ta-smittyezvalyshh-v-ukrayini-2/)

The continued trend of dumping waste at overloaded landfills is a danger to the natural surroundings and increases risks to public health.

The existing practice of operating landfills contributes to land degradation, and the unsustainable use of land, forest and water resources leads to irreversible losses of ecosystems and biodiversity. The share of protected areas (6.6 per cent of the total territory of Ukraine) is not enough for preventing such losses.

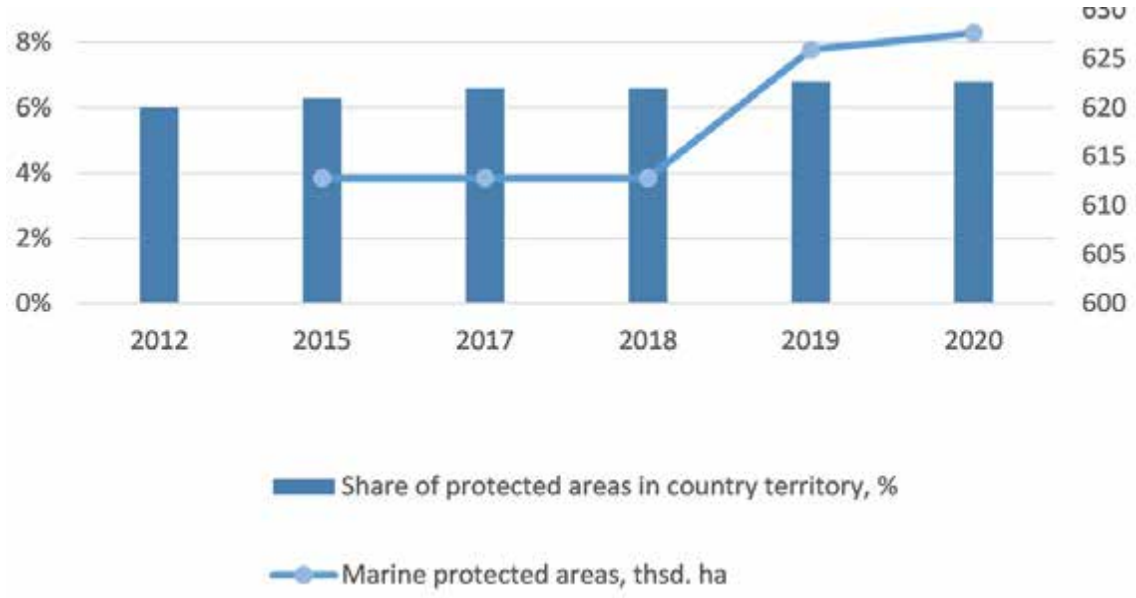


Figure 8.7. Protected areas in Ukraine

(Source: OECD.stat, EU4Environment (2022 forthcoming), "Towards green transformation of Ukraine: State of Play in 2021 Monitoring progress based on the OECD green growth indicators")

Another factor of the combined negative impact on the environment in the National Report mentioned the military conflict in eastern Ukraine. It was noted that significant efforts, resources and time are needed to resolve the effects of the damaged infrastructure and landscapes in Donetsk and Luhansk oblasts.

The full-scale war between russia and Ukraine has exacerbated existing and generated new environmental issues. Despite the fact that a large number of polluting enterprises are not operating as a result of the war, the state of the

environment has only worsened. Estimated environmental damage calculated by the State Environmental Inspectorate as of July 2023 in accordance with approved methodologies amounted to UAH 2,071 billion.

In general, environmental damage caused by military operations can be divided into the following parts:

- mechanical damage to the territory;
- death of animals and plants (including in the sea)
- chemical pollution of air, soil, water bodies;
- contamination by explosive objects;
- potential radiation contamination.

The process of defining the SDG targets and establishing a baseline for monitoring for the next 15 years involved a national discussion on measuring social progress in general and improving the national statistics system. Ensuring conditions for broad participation of all stakeholders in monitoring the achievement of the goals was recognised as a priority.

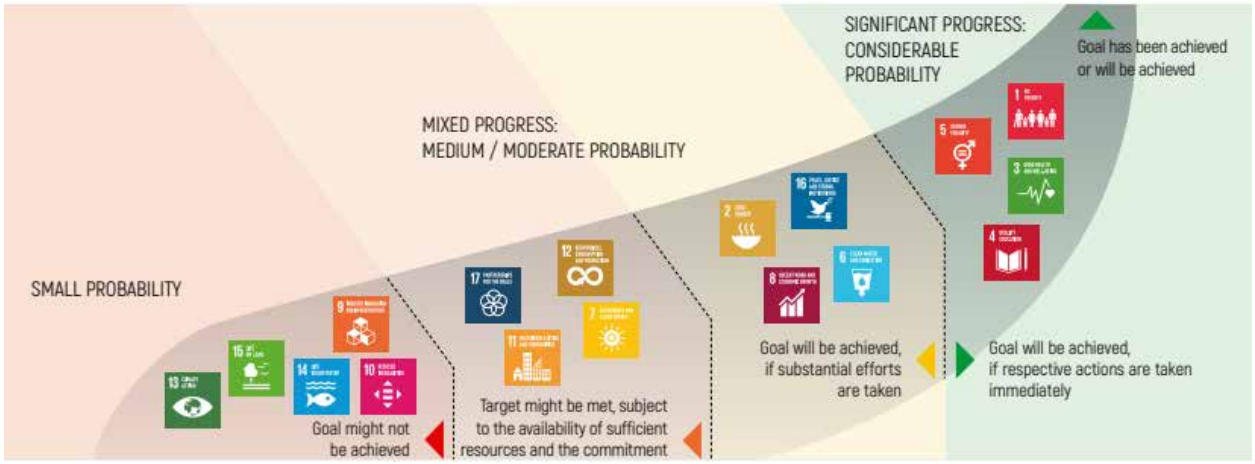


Figure 8.8. Goal ranking by integral estimation of SDG achievement progress, by goal in terms of relevant indicators

(Source: https://ukraine.un.org/en/151096-sustainable-development-goals-voluntary-national-review-ukraine)

Monitoring reports on the SDGs are prepared on an annual basis for 183 SDG indicators under 86 targets. In July 2020, Ukraine presented to the global community its first Voluntary National Review of the SDGs at the High-Level Political Forum.

According to the analysis of progress towards achieving the SDGs in Ukraine, it was found that "about 60% of the target values of the indicators set for 2020 have been achieved. However, progress is uneven, and in some areas it needs to be viewed in the light of the reforms and transformations currently underway."

This includes empowering women, ensuring the quality of education, reducing the burden of epidemics, and protecting the most vulnerable. The goals and targets that have not yet been met are within reach, but efforts to achieve them must be redoubled. This should be done by incorporating sustainable human development aspects into reforms and transformations and identifying an "acceleration momentum" that will allow the country to equalise progress between and within regions.

Before the outbreak of full-scale war in February, Ukraine was making steady progress towards achieving 15 of the 17 Sustainable Development Goals, with the greatest success in reducing poverty. Ukraine's 2021 Voluntary National Survey showed a decrease in poverty from 58.3% in 2015 to 43.2% in 2018. However, these positive trends are rapidly changing: UNDP's preliminary projections suggest that up to 90 per cent of Ukraine's population could face poverty or be vulnerable to poverty if the war continues for another year.

Self-control questions to Topic 8:

1. Name the special features of the technosphere.

2. What is the essence of the concept of the noosphere?

3. In what way the size and scale of the human enterprise have grown since the mid-20th century?

4. What scenarios for the future development of mankind are currently considered the most realistic?

5. What is the idea of the concept of "energy of progress" and who is its author?

6. Among the Planetary Boundaries are:

a. biosphere integrity;

b. biosphere fragmentation;

c. climate change;

d. land-system change;

e. air-system change.

7. What boundaries have already pushed by humans?

8. When was the first UN Conference on Environment and Development?

9. What is the main document adopted at the Stockholm Conference?

10. Name and comment on the general purpose of the concept of sustainable development.

11. What is the relationship of environmental sustainability with other Millennium Development Goals?

12. When the Sustainable Development Goals were officially established?

13. The Rio+20 outcome document calls:

a. Multilateral Environmental Agreement;

b. The Future we Want;

c. Millennium Development Goals;

d. Our Common Future.

14. Give the short characteristic of Ukraine’s environmental issues.

Section 9.
ECOLOGICAL ETHICS AND EDUCATION. ENVIRONMENTAL PSYCHOLOGY AND HUMAN BEHAVIOUR

The great successes of scientific and technological progress have led to the consumerist nature of civilisation, resulting in the atrophy of moral foundations, which leads to a spiritual crisis.

Against this background, a fundamentally new ethics emerges - the "ethics of responsibility". Academician M. Moiseev believed that "in order to secure its future, humanity needs to change its moral principles as profoundly as the one that took place at the dawn of society, when the norms of behaviour in the hordes of neo-anthropes were replaced by human morality".

9.1 Basic principles of environmental ethics

Ethics is the science of morality, its origin, development and role in the social and personal life of people. Ethics studies and shapes the norms of behaviour, a set of moral rules of a class, social organisation or profession.

Aristotle is considered the founder of ethics as a science. This term is most often defined as a set of rules for the most correct, ideal human behaviour. Ethical norms are either imperative in nature, in other words, they prescribe something (for example, love your neighbour, protect nature) or prohibit it (for example, do not kill, do not steal).

They are of an unquestionable nature - they prescribe the pursuit of positive values and prohibit negative actions. In contrast to legal norms, they are "external" in nature, stemming from the life position and development philosophy of an individual.

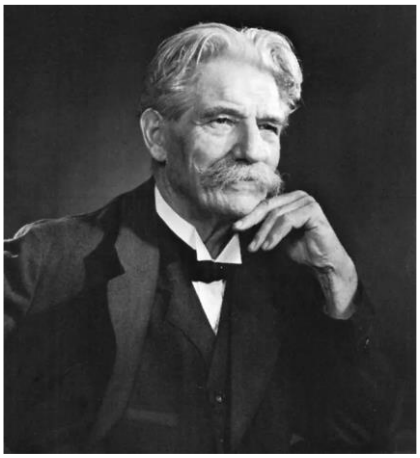
From this perspective, we can say that they are the internal imperative of individuals. The origin of ethical norms can have cultural, religious and other

sources. In our cultural and civilisational system, ethical norms derived from Christian morality are dominant.

Ecological ethics is a symbiosis of ecology and ethics, i.e. the science of moral rules and norms of behaviour from the perspective of the ecological imperative. In other words, environmental ethics is a science of morality focused on both moral relations between people and the moral attitude of man to nature and the entire living world.

The subject of environmental ethics is the study of the foundations of a person's moral attitude to nature, the analysis of stereotypes of human behaviour that lead to environmental problems, and the search for ethical ideals of a person's attitude to nature that will help overcome the environmental crisis (Marushevskyi, 2008). Environmental ethics aims to identify new principles and new approaches to the relationship in the human-nature system, new models of behaviour that will help solve environmental problems.

The emphasis on environmental ethics is essential for a sustainable development strategy, as it is a new type of development that will help avoid environmental problems, or at least mitigate the anthropogenic impact on nature.


Albert Schweitzer

Ecological ethics began to be formed on the basis of the principle of universal ethics of the German philosopher and humanist Albert Schweitzer (1875-1965) - "reverence for life". This principle in Schweitzer's ethics is the main, only and exhaustive one for morally decent human behaviour.

Its essence is the preservation of life - good is everything that serves to preserve and develop life, and evil is everything that destroys or harms life. Therefore, a person's behaviour that respects another's will to live and contributes to its preservation and development is considered right. Schweitzer's ethics are based on the principles of individual responsibility, active individual ethical action,

humanism, independence and creativity of thinking, criticality and rejection of power.


Aldo Leopold

One of the first founders of environmental ethics is the American ecologist Aldo Leopold, who in the 40s of the 20th century noted the connection between ethics and ecology, and his monograph "The Sand County Calendar" is considered the bible of modern environmental ethics.

A. Leopold formulated the main principles of environmental ethics:

1. The principle of evolution - morality evolves and goes through three stages in its development: first, relations between individuals are regulated, then between individuals and society, and at the last stage - between man and nature ("Earth ethics").

2. The principle of human unity with nature - earth ethics simply expands the boundaries of the community, which now includes soils, water resources, plants and animals, united by the word "earth".

3. The principle of conservation - the integrity, stability and beauty of nature (landscape diversity), and the preservation of biological diversity.

4. The principle of integrity - the Earth is seen as an integral system in which higher life forms depend on lower life forms through food chains.

5. Respect for nature - The right of nature to continue to exist and, in some places, to exist in its natural state.

6. Personal responsibility for the state of nature - nature ethics reflects the existence of environmental awareness and the need for personal responsibility for the state of natural systems.

7. Environmental education - training of citizens with a high level of environmental knowledge, environmental awareness and culture.

Culture is a set of material and spiritual values created by mankind throughout its history, which characterises the level of development of society in a certain era and is created to meet the spiritual needs of a person.

Ecological culture is essentially the ecologisation of culture, i.e., taking into account modern environmental laws, problems and needs of the present when creating material and spiritual values. It is intended to promote the comprehensive greening of society's life and activities.

On the other hand, ecological culture is the implementation of modern management based on the rational use of nature with an understanding of current and future consequences, changes in the natural environment as a result of human activity. Environmental culture is created by environmental education, ethics and consciousness.

An understanding of environmental culture and ethics can be seen as early as the Middle Ages.

For example, Saint Francis of Assisi initiated a biocentric ethic of environmental protection through his lifestyle. Comparing himself to the whole of nature as a creation of the Creator, Saint Francis considered not only people, but all creatures living on Earth to be his family. He recognised the right to life and the fulfilment of intrinsic values for every creature. His concern for the natural world was understood by Pope John Paul II, who in 1979 declared him a patron saint of environmentalists.

St Thomas Aquinas had a completely different approach to the culture and ethics of the natural environment. Exploring the mysteries of science, he concluded that man is above nature and has the right to manage the Earth. Exploring the mysteries of science, he concluded that man is above nature and has the right to rule the Earth. He also argued that animals do not possess reason, and this frees people from moral responsibilities towards them. The ethical ideas put forward by St Thomas were distinguished by the absence of any value for non-human beings. This allowed a person to perform arbitrary actions in relation to them.

Michel Montaigne (1533-1592) was one of those Western philosophers who rejected the belief that man was dominant over nature. He believed that humans are an integral part of nature and that all animals and plants have the same right to live in it.

Another French philosopher and mathematician, Descartes (1596-1650), on the contrary, clearly separated human consciousness from the natural world. Unfortunately, modern European philosophy has followed the path set by Descartes. Montaigne's views on the place of man in nature were left by the wayside for a long time.

The Dutch philosopher Spinoza (1632-1677) argued that every form of existence is nature. According to Spinoza, the happiness of each individual lies in the concept of belonging to nature, which allows us to participate in its eternal reality and understand the insecurity of the world around us. Only then, in Spinoza's view, can one attain peace of mind. Spinoza attributed all of nature and the phenomena that arise in it to only one substance and put a sign of equality between God and nature.

In their views, all of the above-mentioned personalities considered specific problems of environmental ethics. The American ecologist Aldo Leopold, the Indian spiritual preacher Mahatma Gandhi, and the French philosopher and theologian Albert Schweitzer proposed a systematic solution to these problems. These personalities are considered to be the precursors of the modern environmental ethics that emerged in the first half of the twentieth century. Despite the fact that their views were shaped by different philosophical and cultural traditions, they understood ethics as a universal value that transcends individual species of life and includes the entire biosphere.

They believed that the most important essence of man was the principle: "The essence of good is the preservation of life and bringing it to the highest level, and evil is the destruction of life, harm and inhibition of its development. This is the basis of ethics, universal and absolute".

Therefore, the main task of environmental ethics can be seen as solving the problem of human identification with other creatures and the environment. The protection of nature and mineral resources is the basis for the future of the human species, its richness and diversity.

Ecological ethics emphasises that people treat the world as they treat themselves. Broadening one's horizons on the protection of life on Earth is also an element of ethics. It is a moral obligation to future generations to be responsible for preserving the environment.

In ecological ethics, ecological assets are the measure of the value of the environment. The evolutionary criterion of progress is based on the choice of a form of development that serves human evolution, but without harming other species. The basis of environmental ethics is interconnectedness, symbiosis and respect for all forms of life.

Thus, the transition to sustainable development is neither a technical nor a purely scientific problem, but rather an ethical transition, a shift in the value orientations of many people. Sustainable development is an ethical ideal aimed at creating a society whose activities do not lead to the destruction of the biosphere.

9.2 Specific features of the concept of ecological education

One of the most important ways to solve the extremely acute environmental and socio-economic problems of modern Ukraine is to train citizens with a high level of environmental knowledge, environmental awareness and culture.

Ecological education is aimed at forming an ecological culture as a component of the system of national and public education of all segments of the population of Ukraine (including through ecological education with the help of public environmental organisations).

Modern national policy in the field of ecological education is based on the following principles:

- accessibility to all groups of the population;

- comprehensiveness of ecological education and training;

- continuity of ecological education in the education system, including advanced training and retraining of management personnel.

The main goal of ecological education is to develop the ecological culture of individuals and society as a whole, to build skills based on in-depth study and awareness of fundamental ecological knowledge, ecological thinking and consciousness based on the attitude to nature as a universal and unique value. For this purpose, a set of measures is envisaged to improve practical pedagogical activities and to solve educational and upbringing tasks in a phased manner.

The formation of the population's ecological culture includes:

- understanding of the current environmental problems of the country and the world, awareness of their importance, relevance and universality;

- revival of the best national traditions in their relations with the environment, cultivation of love for the mother nature;

- awareness of the futility of the technocratic idea of development and the need to replace it with an ecological one, based on the understanding of the unity of all living and non-living things in a complex global system of harmonious coexistence and development;

- understanding of the universality of natural relationships and the need for self-restraint of society, overcoming consumerism towards nature;

- developing a sense of personal responsibility for the environment at the local, regional, national and global levels;

- mastering the norms of environmentally sound behaviour.

Ecological education is based on the principles of humanism, scientificity, continuity, integrity and systematicity. The need to improve, harmonise and standardise terminology in the field of environmental knowledge is recognised as an essential task.

Ecological education is aimed at combining the rational and the emotional in human relations with nature on the basis of the principles of goodness and beauty,

reason and consciousness, patriotism and universalism, scientific knowledge and compliance with environmental law.

Ecological education is a set of the following components:

Each component of this set corresponds to a certain level of environmental maturity: from elementary environmental knowledge and pre-school ideas to their deep awareness and practical implementation at higher levels.

The content of ecological education should be aimed at forming a personality with an ecological outlook on compliance with the norms of environmentally competent behaviour and practical actions to protect one's own health and the environment, and provides for the development of a system of scientific knowledge (ideas, concepts, patterns) that reflect the philosophical, natural scientific, legal and moral and ethical, socio-economic, technical and military aspects of ecological education.

The development of ecological education should be based on the synthesis of three main modern trends:

- formation of modern ecological ideas,
- formation of a new attitude to nature;
- development of new strategies and technologies of interaction with nature.

9.3 Notion of environmental psychology and human behaviour

Ecological psychology is a relatively new field that emerged in psychology two or three decades ago and is rapidly developing at the intersection of psychology, ecology, pedagogy, psychotherapy, sociology, history, philosophy, etc. The mental development, learning and behaviour of a person in different conditions, as well as his or her psychological and mental health, cannot be considered outside the

connection of this individual with the environment (natural, informational, educational, family, and so on) and nature in general.

Ecological psychology studies the mental properties of an individual, personality and individuality in interdependence with the properties of the environment at different levels: physical, chemical, biotic, psychological, social, cultural, historical and spiritual.

The object of ecological psychology is the psychological aspects of the Human-Environment and Human-Nature systems. The subject of environmental psychology is the psychological patterns of human interaction with the environment and the ways of development of man and the environment in the process of this interaction.

A person lives in a certain ecological space that affects him or her. A person also shapes this space, builds it, or, on the contrary, destroys it. A person's psychological condition depends on his or her perception of this space. A poorly designed ecological space (for example, a cramped or dark room with stale air, poorly chosen colours of living or working spaces) has a negative impact on a person's mental state.

On the other hand, there are new psychotherapeutic methods, such as art therapy, nature therapy, marinotherapy, and aromatherapy, which widely use environmental factors (both artificial and natural) to treat mental illness, depression, and generally improve a person's mood and working capacity.

The Chornobyl disaster showed how human activity can affect the environment on a global scale. The Chornobyl accident has been recognised as a global catastrophe by its consequences. The consequences of this catastrophe are studied not only by ecologists and radiologists, but also by physicians, biologists, and sociologists. The psychological consequences of the Chornobyl disaster are studied by psychologists working in various fields of psychology: social, medical and environmental, in particular, radioecological psychology.

The Chornobyl accident caused radiophobia - increased fear of radiation, increased lack of trust, bias in assessing one's health, unmotivated irritability, emotional breakdowns, etc. The previously unknown disease was called "Chernobyl syndrome". In contaminated areas, alcohol consumption increased, including among teenagers. And 30 per cent of six-year-olds were found to have mental retardation.

Ecological psychology is the study of human relationships with the environment. Ecological psychology studies the relationships between environmental variables and various characteristics of the human psyche. This discipline focuses on the study of the relationship between human behaviour and the material environment of the person's environment.

Surrounding environment is a complete, exhaustive set of conditions and circumstances, both physical and socio-cultural, in which a person lives. The main variables in the relationship between a person and the environment are perception and cognition.

Cognition is one of the mental processes by which a person receives, stores, interprets and uses information. Cognition includes various types of processes of sensing, discerning, remembering, imagining, reasoning, decision-making, all of which are related to the life experience and behaviour of a person.

Perception is a holistic reflection of objects, situations and events that occurs when physical stimuli directly affect receptor surfaces. Perception provides direct sensory orientation in the world around us. With the help of this mental mechanism, an individual is able to translate external sensory stimuli into orderly, organised impressions. In ecological psychology, these concepts have their own specificity, which lies in the fact that the entire environment is studied, not any single object.

Ecological psychology research includes three main areas:

- analysis of spatial units that are ranked by size within the context of the study (apartments, residential buildings, hospitals, schools, prisons; neighbourhoods, urban areas, cities, geographical areas; " integrities" or "systems");

- studying environmental phenomena (this includes a limited set of processes related to the satisfaction of human spatial needs: for example, the desire for solitude, the need for personal space, the preference for certain areas, and other phenomena);

- the stage of design for which the research is being carried out, which is a holistic process that begins with the initial definition of design criteria (drawing up a general programme, design, construction, use) and ends with the stage at which the researcher evaluates the success or failure of the proposed solution (the evaluation stage).

The core objectives of ecological psychology are:

- analysis of environmental consciousness inherent in different epochs;

- typology of individual and social in environmental consciousness;

- analysis of the most important trends in the development of individual environmental consciousness in the process of ontogenesis;

- mechanisms of formation of ecological concepts, their role in the regulation of activities related to individual natural objects and nature as a whole;

- features of environmental awareness in different socio-professional groups;

- creation of a special diagnostic arsenal that allows to determine the level of formation and qualitative originality of the system of environmental ideas, subjective attitude to nature and the strategies and technologies used to interact with it;

- development of methods of psycho-correctional and psychotherapeutic work focused on human interaction with the natural world, the impact of this interaction on personality development, etc.

It is also interesting to consider the basic patterns of social psychology of people in relation to nature. People always justify their actions using three main techniques of "ostrich politics": the principle of instinctive denial-confession, the principle of imaginary well-being and the principle of remoteness of the event.

1. The principle of instinctive denial-acknowledgement is that facts and patterns that are conceptually denied by the machine programmer in the depths of the subconscious are involuntarily excluded from the model, and the facts that are determined to be correct are instinctively given more weight than they actually have. In the final version, the programme provides the so-called "desired" option by the programme's compiler, but not the objective one that the researcher consciously or subconsciously strives for when solving the case.

That is why any environmental project assessment should be carried out by a disinterested party.

2. The principle of imaginary well-being, or the euphoria of the first successes. It is associated with too hasty conclusions - the first successes or failures in nature management can be temporary, and the success of measures to transform or manage nature can be objectively assessed only after the course and results of natural chain reactions within a significant natural cycle are revealed and a new ecological balance emerges. An example of ignoring this principle is the tragedy of the Aral Sea and the Aral Sea region, etc.

3. The principle of distance from the event is that phenomena remote in time and space seem psychologically less significant. The misconception that scientific and technological progress in the future will solve all problems has led to the current state and unresolved problem of nuclear power plant waste disposal.

It is probably right to say that we live on the credit of our children and grandchildren. This is because the three principles of "ostrich behaviour" lead to mistakes in environmental management and hinder rational environmental policy, which should always be taken into account.

However, humanity has a long way to go to understand this, which is determined by the rule of economic and environmental perception, in which G. Staikos (1970) identifies four phases:

- neither talk nor action;
- conversations in the absence of action;

- conversations, beginning of action;

- end of conversations, decisive action.

Undoubtedly, the transition of a society from one phase to another is linked to the social consciousness of the society and its economic development.

In turn, in order to adjust human behaviour, B. Commoner's four laws, already mentioned in this manual, were formulated (see Section 1).

Humanity has not created mechanisms that would allow it to "fit in" with nature, but rather has done everything to "rise" above it, to "defeat" it.

9.4 Environmental awareness

It should be noted that ecological psychology tries to identify some integral characteristics that would describe the peculiarities of human interaction with the natural world. Such integral characteristics include, first of all, environmental awareness.

Ecological consciousness in the broadest sense of the word is a sphere of public and individual consciousness, associated with the reflection of nature as part of existence.

The formation of a specific perception of the natural world and a peculiar attitude to this world contributes over time (this is characteristic both for society as a whole and for an individual) to the development of ecological consciousness.

In turn, the formed ecological consciousness has a significant impact both on the peculiarity of perception of natural objects and phenomena and on the specificity of attitude to them.

The problem of forming environmental consciousness became particularly acute in the 20th century, when mankind began to realize the harmful consequences of its activities, which led to the ecological crisis.

We can observe the manifestations of this crisis in various spheres of life: environmental pollution, extinction of a whole range of animals and plants, irrational use of natural resources, etc.

At the same time, philosophical, ecological, psychological and other studies related to the need to understand human interaction with the natural world became more active. This led to the problem (with different variants of its resolution) of formation of environmental awareness.

It was only about 50 years ago that researchers drew attention to the necessity of singling out the concept of ecological consciousness and identifying its structure. Initially, the concept of ecological consciousness was replaced by such concepts as "ecological thinking", "ecological wisdom", "nature conservation thinking". But rather quickly these concepts were integrated into the definition of " ecological awareness".

A number of studies emphasize that there are two positions in modern society and its consciousness, characterized as ecological pessimism (the most predominant position) and ecological optimism (characterized by a utilitarian and enthusiastic view of the future). Along with these, there is also a position that characterizes the indifference of certain groups of people to the environmental problem (due to their preoccupation with their current immediate problems).

Special studies identify four types of carriers of environmental consciousness in terms of solving environmental problems related to the search for new sources of financing. Accordingly, four types of people are distinguished.

The first type is characterized by anxiety about the current environmental situation, concern for the future state of the natural environment, which is accompanied by willingness to pay for high quality of the environment. The second type differs from the first type only by the fact that its representatives do not intend to pay for environmental measures out of their own pockets. The third type is oriented towards changing the environmental situation for the better, but believes that the state should pay for it. Finally, the fourth type is characterised by a low degree of concern about the state of the environment and an unformed opinion on the issue of the correlation between environmental and economic priorities in the state.

In modern psychology, consciousness is understood as the highest, integrating form of psyche, which consists in reflection, goal-setting and constructive-creative transformation of reality. Both in the process of reflection and in the process of constructive-creative transformation, all human mental processes (perception, memory, thinking, imagination) are involved, resulting in the formation of a system of knowledge about the world, which, in turn, finds expression in activity and behaviour.

All these processes are accompanied by a variety of human attitudes (emotional, volitional, etc.), which provide consciousness with its subjectivity and partiality. Environmental awareness is the same consciousness, but it has its own specificity, orientation, associated with the peculiarity of reflection of the natural world and constructive-creative transformation of it.

It should be noted that the problem of ecological consciousness began to become relatively recent, and the subject of ecological psychology became literally in recent decades.

The most fruitful approach may be when one characterises not just the structure of ecological consciousness, but the structure of types of such consciousness.

This makes it possible to differentiate the description of ecological consciousness taking into account the values that express its elements. This problem is solved quite clearly in the concept of S. Deryabo and V. Yasvin. The authors, distinguishing opposite types of environmental awareness (anthropocentric and eccentric), seem to pose the following questions: what is the highest value in the existing world; is there a hierarchical picture of the world; what is the purpose of human interaction with nature, and so on?

As a result, eight attributes of anthropocentric and eight of ecocentric environmental awareness are identified, which in their unity describe the structure of these types of environmental awareness (Table 9.1).

Table 9.1. Structure of anthropocentric and eccentric environmental awareness

Anthropocentric environmental awareness	Eccentric environmental awareness
1. The highest value is the human being	1. The highest value is the harmonious development of man and nature
2. Hierarchical picture of the world	2. Rejection of a hierarchical view of the world
3. The purpose of interaction with nature is to fulfil certain pragmatic needs	3. The purpose of interaction with nature is to optimally fulfil both human needs and the needs of the whole natural community
4. The "pragmatic imperative": what is right is what is useful to man	4. "Ecological imperative": only that which does not disturb the ecological balance existing in nature is right
5. Nature is perceived as an object of human activity	5. Nature is perceived as an equal subject in interaction with humans
6. Ethical norms and rules do not apply to interactions with the natural world	6. Ethical norms and rules apply equally to human interaction and interaction with nature
7. The development of nature is thought of as a process that must be subordinated to human goals and objectives	7. The development of nature is thought of as a process of mutually beneficial unity
8. Conservation activities are driven by a far-reaching pragmatism: the need to preserve the natural environment so that it can be enjoyed by future generations	8. Conservation activities are driven by the need to conserve nature for its own sake and for the sake of people

Anthropocentric environmental awareness is a special form of reflection of natural objects and phenomena of reality and their interrelations, which determines the purposeful and transformative activity of man, characterised by a pronounced opposition between man and nature, where the highest value is man himself, who uses nature to meet his needs and does not apply ethical norms and rules to his interaction with it.

Eccentric environmental awareness is a special form of reflection of natural objects and phenomena of reality and their interrelations, which determines the purposeful and transformative activity of man, which is characterised by giving nature subjective properties, as a result of which nature itself is recognised as a value, relations with it are built on the principles of equality due to the dominance of non-pragmatic motivation and the extension of ethical norms and rules to the natural world.

Modern ecological psychology is not limited only to theoretical descriptions of the identified types of environmental awareness. In recent years, experimental studies of various aspects of environmental awareness have been significantly intensified.

A number of recent studies of environmental values in the public consciousness have revealed a curious fact: the eccentric orientation of consciousness is more characteristic of young people - 17-19-year-olds, for whom nature has an independent value regardless of its possible use. Adults' perception of nature is rationalised to a certain extent. The environment is seen by them primarily as national wealth, a condition for ensuring the economic development of society.

Unfortunately, anthropocentric attitudes prevail both at the level of public and individual consciousness. The system of environmental upbringing and education of the younger generation that has existed so far, despite the declaration of high humane values, has nevertheless been based on the anthropocentric paradigm.

Therefore, the problem of building a fundamentally different system of education for the younger generation, which would fully take into account the achievements of modern environmental philosophy, environmental ethics, environmental psychology and pedagogy, is now particularly acute.

Self-control questions to Topic 9:

1. Describe the relationship between ethics and sustainable development strategy.

2. What does the term "bioethics" mean? Features of environmental ethics.

3. What is the ecological imperative?

4. Name the main principles of Schweitzer's ethics.

5. What is the "principle of evolution" of Aldo Leopold's environmental ethics?

6. The concepts of culture and ecological culture.

7. The biocentric ethics of St Francis. Are his views similar to those of St Thomas Aquinas?

8. Compare the ethical views of Spinoza and Descartes. Which path did modern European philosophy take and is this choice one of the reasons for the current environmental crisis?

9. Which of the following personalities can be considered precursors of modern environmental ethics?

a. Albert Schweitzer;

b. Aldo Leopold;

c. Mahatma Gandhi;

d. all answers are correct.

10. The main task of environmental ethics can be considered:

a. implementation of modern management based on the rational use of nature;

b. solving the problem of human identification with other creatures and the environment;

c. defining certain norms of exploitation of natural resources and the environment.

11. Specific features of the formation of the concept of environmental education in Ukraine.

12. Name the principles of state policy in the field of ecological education.

13. What are the principles underlying ecological education?

14. Structure the components of environmental education according to the level of ecological maturity:

a. Ecological outlook;

b. Ecological ethics;

c. Ecological knowledge;

d. Ecological culture;

e. Ecological thinking.

15. What is studied in ecological psychology?

16. The main variables in the relationship between humans and the environment are:

a. cognitive;

b. emotionality;

c. perception;

d. representation.

17. What are the three main areas of research in environmental psychology?

18. Why is it necessary to create a special diagnostic arsenal in environmental psychology?

19. The main patterns of social psychology of people in relation to nature:

a. the principle of distance of the event;

b. the principle of instinctive denial-confession;

c. the principle of imaginary well-being;

d. all answers are correct.

20. How can you describe the psychological principle of the distance of an event?

21. What phases can be distinguished in the rule of economic and environmental perception?

INDEPENDENT WORK TOPICS

1. The modern concept of social ecology, the structure of social ecology.
2. Sociological approach in the study of ecology. Social ecology laws.
3. Principles of interaction between society and the natural environment.
4. Theory of basic human values.
5. The concept of the human environment and its main elements.
6. Ecology of the living environment.
7. Relationships between human activity and the environment.
8. The relationship between society and nature in the history of civilization.
9. Environmental crisis: its meaning, development phases and signs.
10. Socio-ecological problem and its contradictions.
11. Development models and possible scenarios for overcoming the global environmental crisis.
12. The ways in which humans use natural resources and examples of problems caused by over-exploitation.
13. Public health: historical context and current agenda.
14. The impact of socio-environmental factors on human health.
15. The concept of "healthy lifestyle".
16. The concept of behaviour.
17. Biochemical, biophysical and informational levels of behaviour regulation.
18. Characterization of environmental needs.
19. Ecological and economic problems of urban areas.
20. Socio-demographic problems of Ukraine.
21. Ecological society as a type of social structure.
22. The concept of sustainable development of nature and society.
23. Global Sustainable Development Goals: problems of implementation in war situations in Ukraine.

GLOSSARY

ABIOTIC ENVIRONMENT - forces and phenomena of nature, the origin of which is related to the vital activity of organisms.

ABIOTIC FACTORS - a set of inorganic factors (inanimate nature) of physical or chemical action (climate, light, temperature, pressure, air, wind, radioactive radiation, water, terrain, etc.) that directly or indirectly affect living organisms.

ACCLIMATISATION is the process of adapting animal and plant organisms to the conditions of their existence, which is usually associated with their artificial or natural settlement outside their historical habitats.

ADAPTATION - a complex of adaptive morphophysiological, behavioural and informational-biocenotic reactions that ensure increasing resistance to environmental factors and success in competition.

ADAPTIVE FACTORS - properties of the environment to the impact of which a person is forced to adapt.

ADAPTIVE STRATEGY - a way of human (society) adaptation to changing conditions of existence.

AGROECOSYSTEM - an unstable, artificially created and regularly maintained by man ecosystem of cultural biosystems. Agrosystems, like natural ecosystems, are elementary units of the biosphere (fields, artificial pastures, vegetable gardens, orchards, vineyards, forest plantations, etc.).

ANTHROPHAGENIC FACTORS - factors caused by human activity (gas emissions, wastewater, noise, vibration, radiation that pollute the environment and so on).

ANTHROPOCENTRISM - the view that the human being is the centre of the universe and the ultimate goal of the universe.

ANTHROPOECOSYSTEM is a homogeneously inhabited space characterised by homogeneous forms of human interaction with the environment over time.

ANTHROPOGENIC ENVIRONMENT - the natural environment, directly or indirectly, intentionally or unintentionally altered by people.

ANTHROPOGENIC IMPACT ON NATURE - direct conscious or indirect and unconscious impact of human activity causing changes in the natural environment, natural landscapes.

ANTHROPOGENIC LOAD - the degree of direct and indirect impact of people and their economic activities on nature as a whole or on its individual ecological components and elements (landscapes, natural resources, species, etc.).

ANTHROPOLOGY is the science of human origins and evolution, the formation of human races.

ANTROPOGENETIC MONITORING is a system of observations of changes in human life processes due to the impact of environmental factors, as well as research and assessment of environmental conditions that affect public health and cause the spread of diseases.

APPLIED ECOLOGY is a section of ecology dealing with the development of permissible loads on the environment and ecosystems, norms for the use of natural resources, methods of ecosystem management, ways of "greening" various sectors of the economy, modelling of ecosystems or ecosystem processes, etc.

ASSIMILATION is the transformation of substances coming from the external environment into the body of an organism (protoplasm of its cells or deposits of reserves); a merger of peoples, in which one nation adopts the language, culture, traditions and methods of nature management of another nation.

AVITAMINOSIS is a disease of humans and animals caused by an insufficient number of vitamins in the diet.

BIOGENIC - originating from and related to a living organism.

BIOGENIC MATTER - chemical compounds that have arisen as a result of the vital activity of organisms.

BIOGEOCENOSIS - a complex natural system that unites, on the basis of metabolism and energy, a set of living organisms (biocenosis) with non-living components - habitat conditions; living components of biogeocenosis include autotrophic and heterotrophic organisms.

BIOGEOCHEMICAL CYCLE is the movement and transformation of chemical elements as a result of the active participation of living matter.

BIOINERT SUBSTANCE - substance resulting from the joint activity of living organisms and cosmic (abiogenic) processes (weathering crust, soils, natural waters, etc.), and they represent significantly biogeochemical energy in the biosphere. The term was introduced by V.I. Vernadsky (1926).

BIOSPHERE is a part of the planet Earth that includes the lower part of the atmosphere, the entire hydrosphere and the upper part of the lithosphere, which is inhabited by living organisms.

BIOTA is a historically formed set of plants and animals united by a common habitat.

CIVILISATION - 1) in the broadest sense - a specific way of life of intelligent beings, a component of the planetary biosphere; 2) a historical stage of social development of mankind, following the epochs of savagery and barbarism; 3) a set of material and spiritual achievements of society; 4) material and instrumental, technical and production basis of society; 5) geographically localized, relatively autonomous, stable, integral, historically unique socio-cultural formation (system) of meta-ethnic type; 6) modern global culture, system of values, symbols, practices, way of life

COEVOLUTION - the co-evolution of two or more species of life.

CONCEPT - a system of views, a particular understanding of phenomena and processes; a single, defining idea.

CULTURE - cultivation, upbringing, education, development, veneration - a historically determined level of development of society, creative forces and abilities of man, expressed in types and forms of organization of life and activities of people, as well as in material and spiritual values created by them.

DEGRADATION - deterioration of condition, loss of qualities.

DEMOGRAPHY is a social science that studies the population and the patterns of its development.

DEPOPULATION - a decrease in the size of a human or animal population.

DEPRESSION is a painful state of melancholy, depression, and hopeless despair during certain mental and physical illnesses and neuroses.

DEVELOPMENT is an irreversible, directed, natural change of material and ideal objects. Only the simultaneous presence of all three of these properties distinguishes development processes from other changes. As a result of development, a new qualitative state of an object emerges, which is a change in its composition or structure (i.e., the emergence, transformation or disappearance of its elements or connections).

DIGRESSION - deterioration of ecosystems under the influence of various factors, most often humans.

DISEASE is a process characterised by a violation of the body's structures and functions, a decrease in its adaptability to the environment, while simultaneously mobilising defences.

ECOCIDE - the deliberate criminal destruction of the habitat of all living things, including the destruction of human habitat over a wide area for military purposes.

ECOLOGICAL CULTURE is a condition, an integral part of the universal human culture, characterized by a deep awareness of the importance of harmonious mutual development of society and nature.

ECOLOGICAL ETHICS is an interdisciplinary field of research that emerged as a result of the impact of scientific and technological progress on the

environment and has as its subject the value and ethical problems of the relationship between man and nature.

ECOLOGISATION is the extension of environmental principles and approaches to natural and human sciences, production processes, and social phenomena. In the production sector, it includes three components: maximum efficiency of resource use, reproduction and protection of resources, and the most appropriate ways of using resources.

ECOLOGY - originally a section of biology (bioecology), dealing with the study of relationships of organisms among themselves and with their environment. Modern ecology is focused on the study of the environment and human relations with it, determination of the scale and permissible limits of human society's impact on the environment, search for ways to reduce or neutralise these impacts. In strategic terms, it is the science of humanity's survival, avoidance of ecological crisis and recovery from it. All directions of modern ecology are based on fundamental provisions of biological ecology.

ECOSPHERE ecological sphere, a biological system comprising living organisms and the environment with which they interact.

ECOSYSTEM - any community of living beings and their habitat, existing as a single functional whole. The main features of an ecosystem are the cycle of substances and energy flow, the ability to resist (within certain limits) external influences, self-repair and development.

ENDEMIC DISEASES are diseases that occur in humans for a long period of time in a certain area and are caused by natural and social conditions.

ENVIRONMENT - a set of material forces and phenomena of the environment, its substance and space, human activity that comes into contact with inanimate and living beings; a set of abiotic, biotic and social environments that affect a human being. Environment is a concept adopted by UNESCO, which includes a set of natural, anthropogenic and social factors of human life.

ENVIRONMENTAL CONDITIONS - a set of living organisms, bodies of nature that exist independently of human activity and have an impact on other living organisms, bodies, and phenomena.

ENVIRONMENTAL CRISIS is a situation that occurs in natural ecosystems as a result of an imbalance caused by natural disasters or anthropogenic factors.

ENVIRONMENTAL DEGRADATION is a decrease in the resource potential of natural complexes, simplification of their structure, intensification of harmful natural processes, and pollution with substances toxic to organisms.

ENVIRONMENTAL MANAGEMENT is a sphere of human social and productive activity aimed at satisfying various needs; the theory and practice of rational use of natural resources by humans.

ENVIRONMENTAL MONITORING - monitoring the state of the environment surrounding a man and warning of critical situations that are harmful or dangerous to his health.

ENVIRONMENTAL PROTECTION is a general definition of a system of measures (technological, economic, administrative, legal, international, biotechnical, educational, etc.) that ensure the preservation of natural, resource and environment-reproductive functions of the gene pool, as well as the preservation of non-renewable natural resources.

ENVIRONMENTAL QUALITY is the degree to which natural conditions meet the needs of people or other living organisms.

ENVIRONMENTAL SAFETY is a state of the environment that ensures a balanced impact of various factors and does not disrupt the functioning of ecosystems, the biosphere's ability to self-regulate, or pose a threat to human health.

ETHICS is one of the philosophical disciplines that studies human behaviour.

ETHNOS is a stable community of people that has been formed historically (tribe, people, nation) in a certain territory in the process of developing economic relations under the influence of the natural environment and contacts with other peoples.

ETHOLOGY is the science of animal behaviour.

EVOLUTION is the gradual development of an entity while maintaining its quality in the process of quantitative change (as opposed to revolution, catastrophe, or leap). The process of change, development, transformation of someone or something over time.

GENE is a molecular carrier of an organism's hereditary properties.

GENOFUND - a set of genes of one group of individuals (population, group of populations or species) characterised by a certain frequency of occurrence (genes). National parks, biosphere reserves, zoos, genetic banks, etc. play an important role in the protection and reproduction of the gene pool of plants and animals. The term was introduced by A.S. Serebrovsky (1908).

GEOGRAPHICAL ENVIRONMENT - a set of objects and phenomena of nature (earth crust, lower part of the atmosphere, water, soil cover, flora and fauna) involved at a given historical stage in the process of social production and constituting a necessary condition for the existence and development of human society.

GLOBAL ECOLOGY is a scientific trend that considers the ecological interaction of the biosphere with the processes occurring in the Earth's interior, the space environment and anthropogenic factors (aftereffects of nature-transforming, human production activities).

GOMINIDES - genus *Homo* of the primate order, including both the fossil ancestors of humans - *Homo habilis* and *Homo erectus* - and modern humans.

HEALTH is the process of preserving and developing a person's mental, physiological and biological abilities, his or her optimal working capacity, social employment with maximum life expectancy.

HOMEOSTASIS is a physiological set of complex adaptive functions of the animal and human body aimed at eliminating or limiting the effect of various factors of the internal or external environment.

HUMAN BEHAVIOUR is directed personally or socially significant actions, the source of which is a human being and for which the author's responsibility lies with him or her.

HUMAN DEVELOPMENT is a continuous process of increasing opportunities for qualitative and quantitative choice, which includes the ability to lead a healthy lifestyle for a long time; to obtain education; and access to resources necessary to ensure a normal standard of living.

HUMAN ECOLOGY - section of social ecology, whose task is to study the adaptations of humans or their groups (populations) to the changing environment (in some cases social), the impact of the environment on human health.

HUMAN NEEDS - the need or lack of anything necessary to maintain the vital activity of the organism, human personality, social groups and society as a whole.

IMPERATIVE - an unconditional, categorical requirement; a command, an order.

INDUSTRIAL SOCIETY - a stage in the development of society, one of the main characteristics of which is industrial, commodity and machine production.

LIFE CONDITIONS - a set of conditions of existence necessary for an organism, elements of the environment with which it is in contact; inseparable unity and without which it cannot exist.

LIFESTYLE is an individually peculiar holistic system of sustainable ways and forms of mediation of objective conditions of life by an individual. The concept of "lifestyle" was introduced into psychology by A. Adler, who defined it as "the integrity of the individual".

LIVING MATTER - the totality of bodies of living organisms inhabiting the Earth, regardless of their systematic belonging.

MODE OF INTERACTION BETWEEN SOCIETY AND NATURE is the unity of economic and ecological characteristics of society's development, expressing its relationship to nature and, above all, to the biosphere. In the history of society, three main modes of interaction between society and nature are

distinguished: Paleolithic (co-evolutionary-gathering), Neolithic (production-non-coevolutionary) and noospheric (intensivist-coevolutionary), to which mankind will have to switch for ecological survival.

MONITORING - monitoring of objects, phenomena, living environments or the biosphere as a whole.

MORAL - a spiritual and cultural mechanism for regulating the behaviour of individuals and social groups through ideas of what is right, which summarize norms, values, behavioural patterns, and principles of attitude towards other individuals and social groups.

NEOLITICAL REVOLUTION - a radical change in the way of economy, expressed in the transition from hunter-gatherer economy to an agricultural-pastoralist one.

NON-RENEWABLE RESOURCES - that part of natural resources that is not self-repairing in the process of the biospheric cycle of substances for the time commensurate with the rate of human economic activity.

NOOSPHERE - "thinking envelope" (V.I. Vernadsky), the sphere of reason - a natural stage of biosphere development, when reasonable human activity becomes an important factor of biospheric processes.

PERCEPTION - a holistic reflection of objects, situations and events arising from the direct impact of physical stimuli on the receptor systems of the organism.

PHYTONCIDES are biologically active substances produced by plants that kill or inhibit the growth and development of bacteria, microscopic fungi, and other forms of microorganisms.

POLLUTION is the introduction into the environment or the emergence in it of new substances, phenomena, objects of any nature that have a harmful effect on living organisms.

POPULATION is a set of people living in a large area, taking into account racial, ethnic, gender and age composition.

PROTECTED AREA - a natural area withdrawn from economic use and intended for the preservation of ecosystems, species of living organisms and other natural objects (e.g., minerals).

QUALITY OF LIFE is a set of conditions that ensure (or do not ensure) human health, i.e., the compliance of a person's living environment with his or her needs; compliance of the living environment with the social and psychological attitudes of the individual; a comprehensive characteristic of economic, political, social and ideological factors that determine the position of a person in society.

RENEWABLE RESOURCES - all natural resources within the biospheric cycle of substances, capable of self-recovery within a time frame commensurate with the pace of human economic activity.

SELF-REGULATION is the ability of biological systems to automatically establish and maintain physiological and other biological indicators at a certain, relatively constant level.

SOCIAL ECOLOGY is a scientific discipline that considers relationships in the system "society - nature", the specific role of humans in ecosystems of various ranks, the difference between this role and other living beings, ways to optimise the relationship between humans and the environment, the basis of rational nature management.

SOCIAL FACTOR - a factor that is the result of people's relationships or social structure.

SOCIO-NATURAL SYSTEM - socio-ecosystem - dynamic self-developing system "Human society - Nature".

STRESS is a state of tension in the body; a set of physiological reactions that occur in the human body as a reaction to the impact of adverse factors.

SUSTAINABLE DEVELOPMENT - the development of a society that meets the needs of the present without compromising the ability of future generations to meet their needs.

SYSTEM is a set of interconnected elements that form a single whole, interact with the environment and each other, and have a purpose.

TECHNOSPHERE is a part of the biosphere transformed by people with the help of direct and indirect impact of technical means in order to best meet the socio-economic needs of: human beings. Technosphere is buildings, various kinds of structures, communication systems, production equipment, transport means, etc.

THERATOGEN(S) - biological effects (intrauterine diseases, etc.), chemical substances and physical agents that cause deformities in organisms during their individual development.

URBANISATION DISEASES - a large group of diseases associated with overcrowding and environmental pollution (noise, chemical, biological, etc.).

URBANISATION is a socio-demographic process that involves an increase in the number of urban residents.

WASTE is unused residues of production, household and transport products in the places of their generation that have real or potential value as a product for other industries or for regeneration (recovery).

XENOBIOTICS are foreign substances that penetrate the human body and cause pathological effects.

LIST OF REFERENCES

1. Bates, D.G. (2005). Human Adaptive strategies: ecology, culture, and politics. 3rd edition, Pearson Education.
2. Climate Change Impacts on Health. URL: https://www.rnz.co.nz/national/programmes/ourchangingworld/audio/201759689/climate-change-impacts-on-health
3. Effects of lockdown on human sleep and chronotype during the COVID-19 pandemic by María Juliana Leone, Mariano Sigman, and Diego Andrés Golombek. URL: https://www.cell.com/current-biology/pdf/S0960-9822(20)31007-1.pdf
4. Ehrlich, Paul R. The population bomb. Reprint of the 1968 ed. published by Ballantine. Books, New York, in series: A Sierra Club-Ballantine book.
5. Encyclopedia of Food and Agricultural Ethics Publisher: Springer Editors: P.B. Thompson, D.M. Kaplan, 2014.
6. Encyclopedia of Human Ecology: I-Z. Front Cover. Julia R. Miller. ABC-CLIO, 2003 - Human ecology - 760 p.
7. Engel J. R. The ethics of sustainable development // Ethics of Environment and Development: Global Challenge, International Response. Tucson: Univ/ Arisona Press, 1990. P. 6-8.
8. Environmental Problems. URL: https://www.conserve-energy-future.com/15-current-environmental-problems.php
9. Fischer-Kowalski M (2015) Social Ecology. In: Int. Encycl. Soc. Behav. Sci. Elsevier, pp. 254–262.
10. Gould, Stephen Jay. The Structure of Evolutionary Theory, Cambridge, Massachusetts: Harvard University Press, 2002.
11. Guillaume Simonet. The concept of adaptation: interdisciplinary scope and involvement in climate change / SAPIENS [Enligne], 3.1 | 2010. URL: http://journals.openedition.org/sapiens/997

12. Human Behavior and the Social Environment I by Susan Tyler. University of Arkansas Libraries, Fayetteville, AR

13. Human Biology: An Evolutionary and Biocultural Perspective. Handbook of Evolution Edited by Franz M. Wuketits Francisco J. Ayala, 2000.

14. Human Ecology: Basic concepts for sustainable development. Gerald G. Marten. Earthscan, London, 2001, 238 pp.

15. Human Ecology: How Nature and Culture Shape Our World. Authors: Steiner, Frederick R., 2016.

16. Identification of Health Risk Factors and Their Parameters. URL: https://link.springer.com/chapter/10.1007/978-3-030-19412-3_3#:~:text=For%20example%2C%20some%20of%20the,of%20air%20(WHO%202017b

17. Kothari, C.R. (2004), Research Methodology. Methods & Techniques. Published by New Age International (P) Ltd., 414 p. URL: https://www.modares.ac.ir/uploads/Agr.Oth.Lib.17.pdf

18. Landscaping Principles & Practices, 7th Edition / by Jack E. Ingels, State University of New York, College of Agriculture and Technology Cobleskill, New York (2009).

19. Life support: the environment and human health / edited by Michael McCally/ The MIT Press Cambridge, Massachusetts London, England (2002).

20. M.A. Alihan. Social Ecology: A Critical Analysis (1938).

21. Matthias Gross, "Human Geography and Ecological Sociology: The Unfolding of a Human Ecology, 1890 to 1930−and Beyond," Social Science History (v.28, 2004).

22. Methods of assessing human health vulnerability and public health adaptation to climate change / Health and Global Environmental Change. SERIES No. 1 / World Health Organization 2003.

23. Moran, E.F. (2000). Human adaptability (2nd edition). Boulder, CO: Westview Press, 446 p.

24. Perspectives: An Open Introduction to Cultural Anthropology, 2nd Edition. URL: https://pressbooks.pub/perspectives/

25. Planetary Boundaries: Exploring the Safe Operating Space for Humanity / Johan Rockström, Will Steffen at al. 2009. *Ecology and Society* 14(2): 32. [online] URL: http://www.ecologyandsociety.org/vol14/iss2/art32/

26. Principles of Human Ecology by Peter J. Richerson & al. 2001, 535 pp.

27. Problems of the human environment: report of the Secretary-General [New York]: UN, 26 May 1969, 66 p.

28. Public Health: social context and action. Edited by Angela Scriven and Sebastian Garman. Open University Press, 2007.

29. Rakoid O.O., Bogoliubov V.M. Strategy of Sustainable Development of Nature and society. Textbook for higher education (Second revised edition). Kyiv: NUBIP, 2021. 319 p.

30. Rakoid O.O., Klepko A.V. Social Ecology. Educational and methodological manual for students of Bachelor's Degree in the specialty 101 Ecology. Kyiv: NUBIP, 2023. 89 p.

31. Rakoid O.O., Solomenko L.I. Human Ecology. Study guide. Kyiv: NUBIP, 2020. 191 p.

32. Raul P. Lejanoa, Daniel Stokols. Social ecology, sustainability, and economics, Ecological Economics Volume 89, May 2013, Pages 1-6.

33. Report of the United Nations Conference on Environment and Development (Rio de Janeiro, 3-14 June 1992).

34. Roderick J. Lawrence. Human Ecology - Encyclopedia of Life Support Systems. University of Geneva, Switzerland. URL: http://www.eolss.net/sample-chapters/c04/e6-23-06.pdf

35. Sandra Roberts. Human Physiology. First Edition, 2007. Published by: Global Media, 390 p.

36. Schutkowski H. Human Ecology: Biocultural Adaptations in Human Communities, Springer-Verlag Berlin Heidelberg 2006, 310 pp.

37. Scientific Method for Ecological Research / By E. David Ford, Cambridge University Press (2004). 586 p.

38. Sullivan, Robert & Dwyer, Michael & Rogers, Karla. (2016). Conceptual Frameworks for Human Interactions with Public Lands in the Western United States. Conference: National Association of Environmental Professionals Annual Conference - April 11-14, 2016. At: Chicago IL

39. Sustainable Development. Linking economy, society, environment (By Tracey Strange and Anne Bayley). OECD Publishing, Paris 2008.

40. The big global environmental issues we need to resolve by 2030. URL: https://www.iberdrola.com/environment/most-important-environmental-issues

41. The Ethical Dimensions of Global Environmental Issues. URL: https://www.amacad.org/publication/ethical-dimensions-global-environmental-issues

42. The nine planetary boundaries. URL: https://www.stockholmresilience.org/research/planetary-boundaries/the-nine-planetary-boundaries.html

43. The Transition to a Green Economy: Benefits, Challenges and Risks from a Sustainable Development Perspective Report by a Panel of Experts to Second Preparatory Committee Meeting for United Nations Conference on Sustainable Development, 2012.

44. The Ultimate Guide to Indoor Plants. URL: https://www.ambius.com/blog/the-ultimate-guide-to-indoor-plants/

45. Transforming our world: the 2030 Agenda for Sustainable Development. URL: https://sustainabledevelopment.un.org/post2015/transformingourworld

46. Ukraine Demographics. URL: https://www.worldometers.info/demographics/ukraine-demographics/#tfr

47. Ukraine: Public Health Situation Analysis. Updated: May 2023. 95 p.

48. Understanding Human Ecology. Knowledge, Ethics and Politics by Geetha Devi T. V., 2019, 240 pp.

49. Understanding Human Ecology: A Systems Approach to Sustainability. By Robert Dyball and Barry Newell. London and New York: Routledge, 214 pp., 2015.

50. van Ginneken V, van Meerveld A, Wijgerde T, Verheij E, de Vries E, et al. (2017) Hunter-prey correlation between migration routes of African buffaloes and early hominids: Evidence for the “Out of Africa” hypothesis. Integr Mol Med 4: DOI: 10.15761/IMM.1000287

51. What makes us Human? Edited by Charles Pasternak. Published by Oneworld Publications 2007, 243 p.

52. Аналітичний звіт «Базове дослідження стану та напрямів розвитку екологічної політики України та перспектив посилення участі організацій громадянського суспільства у розробці та впровадженні політик, дружніх до довкілля». URL: https://www.irf.ua/wp-content/uploads/2019/12/baseline-research_report_publishing-dec-2019.pdf

53. Вернадский В.И. Биосфера. М., 1967. 376 с.

54. Воловик В.М. Тріада життя (біосфера, етносфера, ноосфера): Навчальний посібник. Вінниця, 2003. 116 с.

55. Гор А. Земля у рівновазі / Переклад з англ.: Інститут сталого розвитку. К.: Інтелсфера, 2002. 312 с.

56. Катков М.В. Соціальна екологія: Конспект лекцій (для студентів 4 курсу денної форми навчання напряму підготовки 6.040106 „Екологія, охорона навколишнього середовища т збалансоване природокористування”). Х.: ХНАМГ, 2012. 30 с.

57. Концепція екологічної освіти, затверджена рішенням Колегії Міністерства освіти і науки України, протокол № 13/6-19 від 20.12.2001 року

58. Короткий курс соціоекології. Методичні рекомендації до вивчення дисципліни «Соціоекологія та екологічна етика» / Автори: Хом'як І. В., Демчук Н. С., Мостіпака Т. П. Житомир: вид-во ЖДУ ім. І. Франка, 2019. 95 с.

59. Крисаченко В.С. Людина і біосфера: основи екологічної антропології. Підр. К.: Заповіт, 1998. 688 с.

60. Кунах О.М., Жуков О.В. Соціальна екологія: Навчально-методичний посібник, Дніпро: типографія «АРБУЗ», 2021. 61 с.

61. Марушевський Г.Б. Етика збалансованого розвитку. К.: Центр екологічної освіти та інформації, 2008. 440 с.

62. Національна доповідь "Цілі сталого розвитку: Україна". Міністерство економічного розвитку і торгівлі України, 2017. 176 с.

63. Національна платформа звітування за ЦСР (відкрита платформа ЦСР). URL: https://ukrstat.gov.ua/csr_prezent/2020/ukr/st_rozv/menu.htm

64. Програма дій "Порядок денний на 21 століття"/ Пер. з англ.: ВГО "Україна. Порядок денний на 21 століття". К.: Інтелсфера, 2000. 360 с.

65. Руденко М. Енергія прогресу. Вибрані праці з економії, філософії і космології. / Упоряд. Р. А. Руденко - К.: ТОВ "Видавництво «КЛІО», 2015. 680 с.

66. Соломенко Л.І. Екологія людини: навч. посіб. К.: «Центр учбової літератури», 2016. 120 с.

67. Стратегія сталого розвитку: Підручник: перевидання / [В.М.Боголюбов, М.О. Клименко, Л.Г. Мельник, О.О. Ракоїд, Л.І. Соломенко, В.А. Прилипко]. За редакцією проф. В.М. Боголюбова. К.: ВЦ НУБІП України, 2019. 449 с.

68. Тихомірова, Ф. А. Соціальна екологія міста як проблемне поле соціальної філософії. *Актуальні проблеми філософії та соціології*. 2019. (Вип. 25).

69. Шевчук В.Я., Белявский Г.О., Саталкін Ю.М., Навроцький В.М. Ноосферогенез і гармонійний розвиток. К.: Геопринт, 2002. 127 с.