NATIONAL UNIVERSITY OF LIFE AND ENVIROMENTAL SCIENSES OF UKRAINE

Department of General Ecology, Radiobiology and Safety of Life Activity

SOCIAL ECOLOGY

Educational and methodological manual for students of Bachelor's Degree in the specialty 101 Ecology

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У навчально-методичному посібнику для студентів ОС Бакалавр за спеціальністю 101 Екологія вперше англійською мовою ґрунтовно викладені теоретичні і практичні аспекти навчальної дисципліни «Соціальна екологія». Навчально-методичний посібник містить 8 тем, де подано як основні теоретичні положення, так і практичні роботи та список відповідних питань для самоконтролю студентів.

LIST OF CONTENT

INTRODUCTION

Development of modern scientific knowledge is characterized by the integration of approaches and disciplines. Social ecology is a branch of sociological knowledge that combines the natural science and humanities profiles.

In addition to enriching the cognitive potential of interdisciplinary research, it allows us to go beyond the usual social relations "individual-individual", "individual-social group" and "individual-social institution". New types of relationships studied in society are emerging: "personality-environment", "social group-environment", "social institution-environment", "society-environment". The analysis of the latter is the object of research in 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 main goal of social ecology is to optimize the coexistence of man and the natural environment on a systemic basis. The purpose of the course of this academic discipline is to provide a holistic view of social ecology, which studies the spatial and temporal features of the interaction between society and nature.

The purpose of this educational and methodological manual for students of Bachelor's Degree in the specialty 101 Ecology is to provide bachelors with a basic understanding of the global problems of human civilization and the diversity of activities in the sphere of nature management.

The system of environmental education should form an environmentally oriented person who is able to apply knowledge, abilities and skills, as well as personal qualities to solve problems of professional activity, social participation and achieving personal success within the framework of sustainable development.

The main tasks of the discipline are:

- to form in students ideas about the ideological origins and historical preconditions for the formation of social ecology; about the integrative nature of socio-ecological knowledge, about the problem of the relationship between human beings, society and nature throughout the history of humankind;

- to consider the ways to optimize human existence and the environment at the system level;

- to demonstrate the relationship between the level of anthropogenic pressure and the quality of life of the population;

- to give an idea of the moral aspects of society's attitude towards the environment, the foundations of ecological culture and environmental education of citizens.

Mastering the course, including performing self-study assignments, will allow students to form professional skills and competencies necessary for subsequent work, namely: skills of searching and structuring information, analysis of secondary sociological research, establishing cause-and-effect relationships, trends and contradictions, mastering the methods of socio-ecological research and applying them appropriately to the tasks and goals set.

Section 1.

SOCIAL ECOLOGY: SUBJECT, METHODS, PRINCIPLES AND LAWS

Basic theory

1. Historical backgrounds of social ecology (human ecology); milestones and foundational works;

2. Definition, object and subject matter of social ecology;

3. Methods used by social ecology;

4. Principles of social ecology;

1. Historical backgrounds of social ecology (human ecology); milestones and foundational works

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*.

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".

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.

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. 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. Simply, clearly, and forcefully written, it carried the message that the use of chemicals, particularly chlorinated hydrocarbons, had grave consequences.

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.

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".

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.

2. Definition, object and subject matter 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.

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.

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.

The **o***bject* 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.

3. Methods used by social ecology

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.

4. Principles 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*.

Five laws of social ecology by N.F. Reimers:

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.

Practical lesson 1

Task: to provide insight into social ecology as a complex interdisciplinary science that determines the spatio-temporal position of human in the system of nature and the world around us.

Learning activity

Fill in the table that summarizes the laws of the famous American ecologist Barry Commoner and the patterns reflected in them. Provide your own relevant examples to illustrate these laws.

Table 1.1 B. Commoner's laws

Formulation of the law	Regularities reflected in the law	Examples of how the law works
1. Everything Is Connected to Everything Else		
2. Everything Must go Somewhere		
3. Nature Knows Best		
4. There Is No Such Thing as a Free Lunch		

Self-control questions

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

Basic theory

1. The concept of the human environment and its main elements;

2. Social components of the environment;

3. Socio-environmental interaction. Human adaptation to environmental conditions;

4. Environmental and social stressors;

5. General patterns of human adaptation.

1. The concept of the human environment and its main elements

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.

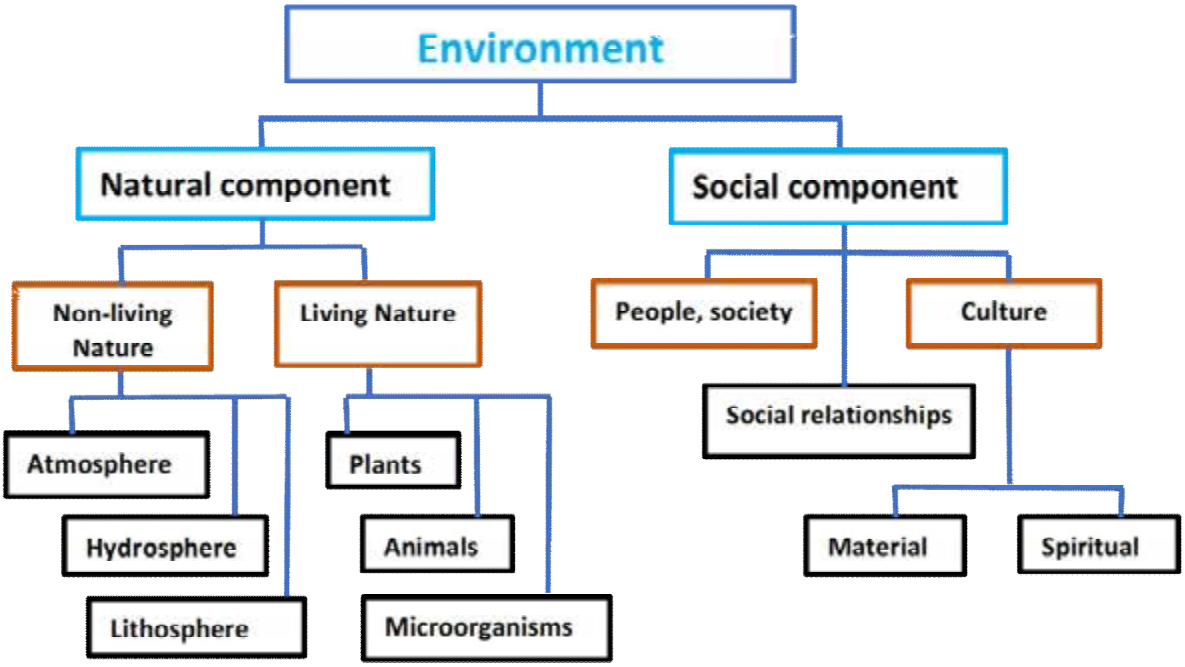

Figure 2.1. Components of the environment of human and society (by D. Zh. Markovich)

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).

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. 2.2.).

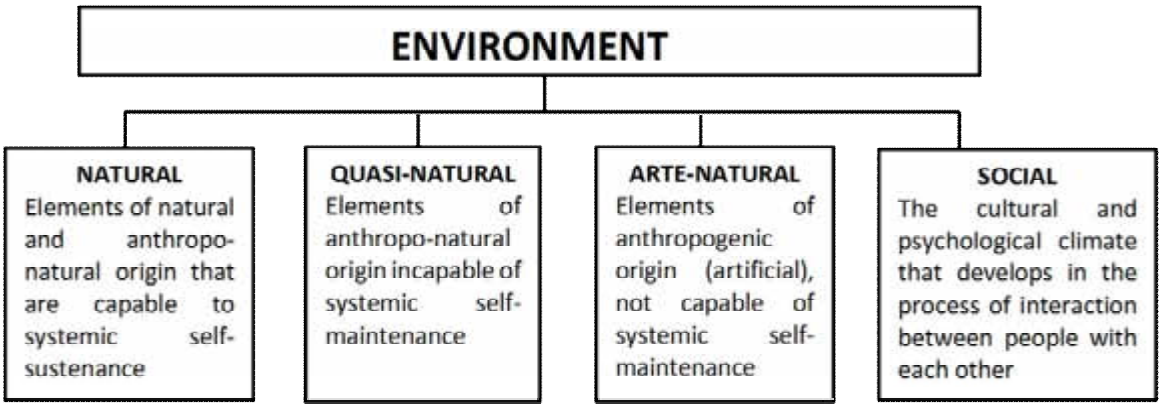

Figure 2.2. Components of the human environment (by N.F. Reimers)

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. 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.

3. Socio-environmental interaction. Human adaptation to environmental conditions

Therefore, 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.

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.

With the change of certain components of the environment, the human body is forced to change some of its functions. There is a restructuring of its homeostasis (internal environment and the activities of various body systems) in accordance with specific conditions, which is the basis of adaptation.

Thus, adaptation is a specific chain of reactions of body systems, in which some of them change their activities, others regulate these changes.

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.

4. 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. 2.3.).

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.).

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.

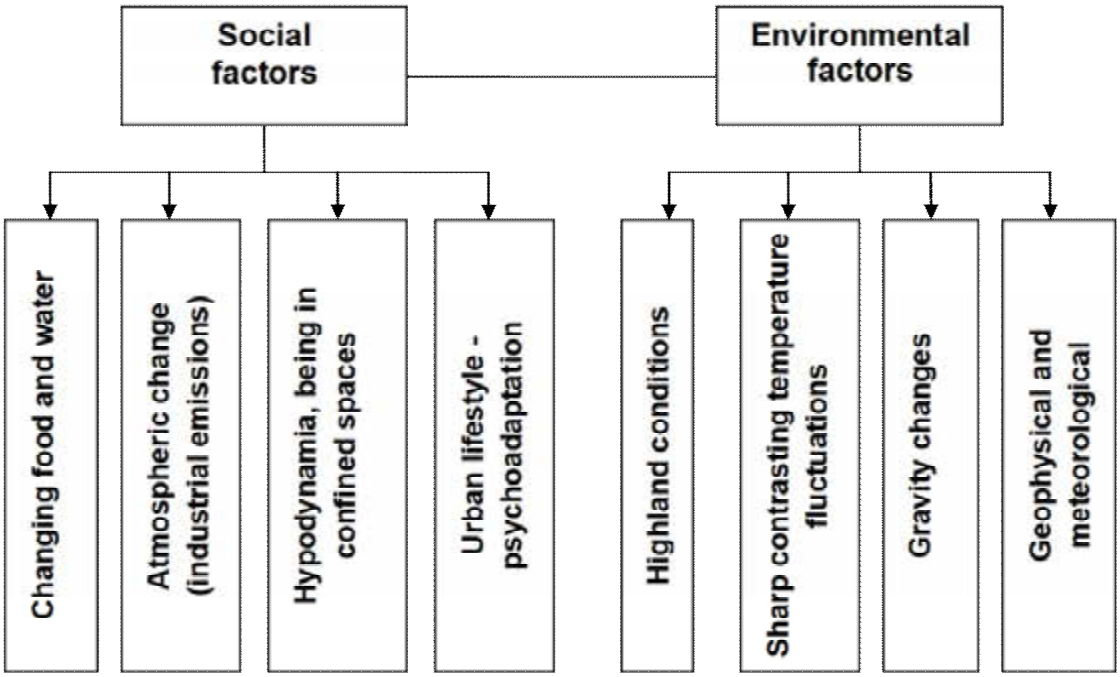

Figure 2.3. Stress factors

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.

5. 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. 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.

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.

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.

Practical lesson 2

Task: To extend knowledge about the basic elements of the environment and their influence on human living conditions. To study the concept of human adaptation as a reflection of the process of connection of man with the environment and its changes.

Learning activity

1) Fill in the table 2.1 (Components of the human environment according to N.F. Reimers). Provide some examples to illustrate these components.

Table 2.1 Components of the human environment

Component of the environment	Examples
1. Natural	
2. Quasi-natural	
3. Arte-natural	
4. Social	

2) Give some examples of adaptive strategies in your (the student's) life and complete Table 2.2.

Table 2.2. Examples of adaptive strategies

Type of strategy	Example
Passive	1.
	2.
	3.
Active	1.
	2.
	3.

Self-control questions

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

8. 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)

9. 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.

10. Social stressors include:

a) highland conditions;

b) gravity changes;

c) hypodynamia;

d) high noise.

11. 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?

12. 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.

13. 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*

14. 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;

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

16. 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.

Section 3.

HUMANS AS THE MAIN SUBJECT OF BIOSPHERIC CHANGE

Basic theory

1. Human evolution;

2. Human as a natural and social being;

3. Human uniqueness.

1 Human evolution

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

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").

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.

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.

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.

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.

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.

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 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.

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.

3. Human uniqueness

As a member of the Hominidae family, humans had some favourable 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.

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.

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.

Practical lesson 3

Task: To study and discuss the problem of human uniqueness as the main subject of Biospheric change.

Learning activity

Prepare a short presentation (report) on the origin and evolution of humans. Make an argument for why humans have taken a dominant position at the present stage of the evolution of the Biosphere.

Self-control questions

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:

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

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

Section 4.
HUMAN–ENVIRONMENT INTERACTIONS

Basic theory

1. The Evolution of Social Ecological Systems;

2. Threats to the balance in nature by human activities;

3. The relationship between human and nature and problems of modern civilization.

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.

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 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.

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.

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***. 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.

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.

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.

2. 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.

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 understand that the Earth is a unique planet. It is under very special circumstances that its life support systems have evolved. We must take special care to maintain the equilibrium between the various components of the Earth system so that life on this planet may flourish and progress.

3. 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 |ˈkɒŋkə| 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.

Practical lesson 4

Task: To get acquainted with the main problems that arose at each stage of the formation of the Human-Society-Nature system. To extend knowledge about the causes and consequences of the global environmental crisis

Learning activity

List the global problems of humankind (for your consideration), structuring them in a table format (Table 4.1). For any three of the global problems you mentioned, state: what caused the problem; the rate of development of the problem at the present stage; ways to solve the problem.

Table 4.1 Global problems of humankind

Global problems	Essence of the problem	Components of the problem		
		ecological	economical	social
1. 2. 3. etc.				

Self-control questions

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.

Section 5-6.

THE RELATIONSHIP BETWEEN HUMAN HEALTH AND ENVIRONMENTAL FACTORS

Basic theory

1. Human health as a comprehensive indicator of the state of human society;

2. The impact of the natural environment on humans;

3. Abiotic factors;

4. Biotic environmental factors;

5. Anthropogenic impact on nature and human health.

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.

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 5.1 Risk factors for the formation of human health

Spheres	Specific weight, %	Group of factors
Way 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

Way 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.

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).

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

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

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.

2. The impact of the natural environment on humans

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.

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.

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

Space, helio- and geophysical factors. 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, on the other hand - to increase the aggressiveness of pathogens and natural circulators of infections.

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.

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.

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.

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.

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.

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.

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.

3. Anthropogenic impact on nature and human health

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.

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.

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.

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.

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.

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.

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 effects of these contaminants on the human body tends to persist over time and across generations.

Practical lesson 5

Task: assess the functional state of the body by using various tests; identify the level of physical fitness and physical working capacity, as well as health status.

Devices and equipment: tonometer for measuring of the blood pressure; stopwatch.

Additional Information

The human body has homeostatic adaptive regulatory mechanisms.

Adaptive regulation of physiological changes that developing in cells, organs, tissues, systems and the body as a whole, can be realized in the form of escape from an adverse stimulus, or passive submission to it as well as active counteraction to the environment due to specific adaptive reactions.

Homeostatic mechanisms try to stabilize this new level, i.e. to keep the activity of functional systems in it and to prevent deviations of physiological parameters from the new adaptive information.

Because during his lifetime the individual is exposed to various stimuli requiring adaptation, everyone should know and properly assess the capabilities of their body:

Energy potential → working capacity → endurance of an organism

The reasons for reducing natural potential: hypokinesia (physical inactivity); overeating (increase by 1 kg of body mass); bad habits; low production standards; interpersonal relationships.

Learning activity

Apply functional tests to assess physical working capacity in order to determine the adaptive potential of the human body.

Procedure of work

1) Test with 20 squats:

- Sitting on a chair, measure your heart rate (heart rate in 10 seconds to a stable heart rate in 10 seconds: 12 – 11 – 10 – 10 – 10 → 10 beats per 10 seconds).
- Do 20 squats stretching your arms forward.
- Sit down and fix time to restore heart rate to baseline (10).
- Assess your condition on a scale (Table 5.1).

Table 5.1 − Scale for assessing physical working capacity

Recovery time	Rating
Up to 1 minute	“Perfectly well”
2 minutes	“Fine”
More than 3 minutes	“Badly”

2) Orthostatic test − the more perfect the apparatus of regulation, the less expressed the adaptive response. Orthostatic faintness is deterioration in the cerebral blood supply.

- ❖ Lying down: in 15 seconds measured to stable heart rate.
- ❖ Heart $rate_1 \times 4$ → pulse frequency for 1 minute
- ❖ Slowly: calmly gets up → for 15 seconds heart rate is measured.
- ❖ Heart $rate_2 \times 4$ → pulse frequency for 1 minute
- ❖ Evaluate the apparatus of regulation of cerebral blood supply on the scale:

$Heart\ rate_2 - Heart\ rate_1 < 12$ – **normal test**

$Heart\ rate_2 - Heart\ rate_1 > 18$ – **unfavourable test**

3) Holding of breath:

- 1 - 2 expirations → take a deep breath and hold it.
- Measure the time of duration of possible breath-holding.
- The results are evaluated on a scale (Table 5.2).

Table 5.2 − Respiratory system assessment scale

Breath-holding of man	Breath-holding of women	Rating
60 seconds	50 seconds	“Perfectly well”
< 40 seconds	< 30 seconds	“Badly”

4) Computational method for determination the indicator of adaptive potential of the organism (R.M. Baevsky's and others method, 1988).

- ✓ Determine the adaptive potential of the organism by the formula:

$$\mathbf{AP}=0{,}011\times \mathbf{PF} +(0{,}014 \times \mathbf{SBP})+(0{,}008 \times \mathbf{DBP}) +(0{,}014 \times \mathbf{A})+(0{,}009 \times \mathbf{BM}) –$$

$$(0{,}009\times \mathbf{H}) - 0{,}27$$

AP – adaptive potential in points;
PF − pulse frequency for 1 minute;
SBP − systolic blood pressure;
DBP − diastolic blood pressure;
A − age (number of years)
BM − body mass, kg;
H – height, centimetres.

✓ The results obtained are evaluated on a scale:

Scale for assessing the state of the cardiovascular (or circulatory) system (in points)

satisfactory adaptation	≤ 2.1
stressing of adaptation mechanism	2.11 – 3.2
unsatisfactory adaptation	3.21 – 4.3
failure of adaptation	≥ 4.3

✓ Determine the ideal mass of your body by comparing it with the actual.

For men: 50+ (height in cm - 150) × 0.75 + (age, years - 21) / 4

For women: 50+ (height in cm - 150) × 0.32 + (age, years - 21) / 4

✓ When comparing the actual and estimated body mass take into account the following ratios:

excess up to 5% − body weight within normal limits;
excess in the range of 5-14% − the mass is excess;
in excess of 15-20% − obesity of the first degree;
in excess of 30-49% − obesity of the second degree;
in excess of 50- 99% − obesity of the third degree.

5) Make a conclusion about the assessment of the adaptive potential of your body.

Practical lesson 6

Task: Study houseplants which emit phytoncides into the environment. Make a list of plants that may be needed, taking into account your health and aesthetic perception

Learning activity

Get acquainted with phytoncide plants and discover the possibilities of their use in the interior.

Procedure of work

1) Have a look at live specimens of the proposed plants (Fig. 6.1.).

2) Examine their morphological features: the structure of the stem, leaves, flowers, fruits.

3) Become acquainted with the properties of the best known phytoncide plants as well as with the attitude of people to them, which has developed during the historical development of society.

4) Using the literature, make lists of 15-20 houseplants that show their phytoncide properties, taking into account their characteristics.

5) Record the results in Table 6.1.

1 **2** **3** **4**




5 **6** **7** **8**

Figure 6.1 − Houseplants:

1- Tree-like aloe (Aloe arborescens); **2**- Kalanchoe (Kalanchoe daigremontiana); **3**- Dwarf rosemary (Rosmarinus officinalis); **4**- Lemon tree (Citrus limon); **5**- Chlorophytum; **6** - Eucalyptus Globulus; **7**- English ivy (Hedera helix); **8**- Myrtle (Myrtus communis)

Table 6.1 - Ecological features of plants used for interior design

Item No.	Plant botanical name	Plants with bright flowers	Plants with decorative leaves	Demand for light	Phytoncidal and other useful properties
1	Tree-like aloe (*Aloe arborescens*)	–	–	light-demanding	The plant has bactericidal and bacteriostatic properties
…					
20					

Analysis of results and conclusions

❖ Make a plan of interior landscaping depending on its functional purpose (optional): lobby, administrative office, winter garden, glazed gallery, long corridor, hospital ward. The lighting and temperature of these rooms should be taken into account.

❖ Draw conclusions about the effects of plants on humans.

Self-control questions:

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. Specific weight of lifestyle (way of life) as one of risk factors for the formation of human health:

a) 18–22 %;

b) 8–10 %;

c) 49–53 %;

d) 17–20 %.

4. 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*

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

6. Way of life includes three categories: standard of living, … , and lifestyle. (fill in the omitted words)

7. The standard of living is primarily:

a) an economic category;

b) a social category;

c) a socio-psychological category;

d) a biological category.

8. Three categories that way of life includes:

1. The standard of living	*A. is a degree of comfort in meeting human needs*
2. Quality of life	*B. characterizes the behavioral features of human*

	life
3. Lifestyle	*C. reflects the degree of satisfaction of material, spiritual and cultural needs of man*

9. 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.

10. A healthy lifestyle is a way of living that increases the risk of being seriously ill or dying early, isn't it?

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

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

13. The influence of the Sun on human is associated with….

14. 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.

15. Among climatic and meteorological factors human is most affected by:

a. relative humidity;

b. radioactive contamination;

c. temperature;

d. atmospheric pressure;

e. solar activity.

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

a. relative humidity;

b. temperature;

c. atmospheric pressure.

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

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

19. Does lack or excess a certain chemical elements and substances in the environment can determine the health of definite populations?

20. Endemic diseases are called so because they:

a. developed during the natural evolution of organic society

b. associated with regional edaphic, hydrological or epidemiological features

c. led to unpredictable serious violations of the laws of the biosphere

d. supplied material for natural selection

21. 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).

22. Phytoncides are:

a. bacterial antagonists;

b. antagonists of fungal infection;

c. antagonists of protozoa;

d. one of the factors of natural plant immunity;

e. all the above answers are correct.

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

24. Atmospheric air pollution is a common cause of:

a. respiratory diseases;

b. mental diseases;

c. behaviour disorders.

25. Intestinal infectious diseases mostly caused by … (fill in the omitted words).

26. 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.

27. 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.

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

29. The statistics shows that in the structure of population morbidity in Ukraine the first place is occupied by:

a. gastrointestinal diseases;

b. respiratory diseases;

c. diseases of the circulatory system;

d. diseases of the nervous system and sense organs.

30. 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

Basic theory

1. Demographic problems of Ukraine;

2. Ethnos as the source of the ecological and social system;

3. Ecological and economic problems of urban areas.

1. Demographic problems of 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* − write) − a social science that studies the population and patterns of its development.

Demographic problems of mankind along with issues of society structure, population migration, ethnic, racial and religious composition determine the ecology of human communities, which confirms the legitimacy of human-centered approach in environmental doctrine.

Having crossed the thirty-year mark of the period of independence and radical socio-economic transformations in Ukraine, it must be acknowledged that the socio-demographic situation in the country remains extremely unfavourable.

Its crisis proportions are determined by a combination of large-scale depopulation with the deterioration of the qualitative characteristics of the population, in particular of public health.

During the years of independence, the country's population decreased by 5.3 million people, including only due to depopulation − by almost 4.6 million. And this trend is observed even today.

The socio-economic crisis of the 1990s accelerated and intensified unfavorable trends in the dynamics and structure of major demographic processes. During the first decade of transformation in Ukraine, the birth rate decreased steadily and at an accelerated pace, and single-child and childlessness spread.

In 2020, the total birth rate in Ukraine was 1.4 children per woman and is one of the lowest in Europe. Among the main factors of low birth rate and its unfavorable trends in our country first and foremost, it should be noted that the demo reproduction process sufficiently is not provided economically.

Life expectancy (67.6 years for men; 77.3 years for women) is currently higher than in 1960 (when life expectancy in Ukraine exceeded its then level in Japan, France or Germany). But Ukrainian men now live on average 12 to 13 years, and women − 8 to 9 years less than in the European Union.

During the period of independence and economic transformations in Ukraine there was a decrease in the intensity of stationary migration, new forms of migration moved significantly: labor migration, refugee movement, transit of illegal migrants, and return of formerly deported peoples.

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.

2. Ethnos as the source of the ecological and social system

People (from the Greek word *ethnos*) are a multifaceted concept. Most often, this term has the following meaning: ethnos is a historical community of people that has developed in a certain area and has stable features of language, culture and mental composition, as well as awareness of their unity and differences from others.

For the internal unity of the ethnos, the most important thing is culture, which gives people a sense of community. Culture, both as a necessary component and as one of the inherent features of the ethnos, ensures its full functioning. But also occurs a reverse process − the convergence (rapprochement) of ethnic cultures − due to historical development and interaction of peoples.

Therefore, today culture of each ethnic group is characterized by a set, on the one hand, national-specific, and on the other − universal components.

The formation of ethnic culture is inextricably linked with the formation of the people themselves (ethnogenesis). Thus, considering the Ukrainian culture, it is cannot refrain from reflecting on the problems of Ukrainian's ethnogenesis.

In modern literature, the beginning of the nation-genesis of Ukrainians is considered to be the period of Kyivan Rus, although it did not reach its end then. Subsequently, due to unfavorable historical circumstances, this process was interrupted and resumed in full force in the XV-XVII centuries. This is probably the specificity of the ethnogenesis of Ukrainians.

Today, Ukrainians make up the mainstream population of Ukraine. They are one of the largest nations in Europe and the second largest − in the Slavic world. Mostly Ukrainians are evenly distributed throughout the country except for the Crimea and the southeast. In rural areas they make up to 90% of the population, in cities − up to 70%.

Socio-economic conditions have become decisive factors that determined the formation of the modern face of the Ukrainian nation, influenced the number and geographical location of other ethnic groups, the nature of ethnic processes in Ukraine in general.

3. Ecological and economic problems of urban areas

Exacerbation of regional environmental problems is significantly influenced by urbanization processes, i.e., the growth of the number and density of urban settlements.

A city is an anthropogenic ecosystem, which is a place of compact accommodation of people, industrial and domestic buildings, separated by a conditional boundary from the external environment.

There are 461 cities (on 1 January 2019) and more than 880 urban-type settlements in Ukraine, where is located a significant part of industrial enterprises (over 80%) which are forming the main man-made load on the environment. Thus, according to national statistics, up to 90% of different types of waste are generated in cities and only 10% − in rural areas.

The city is characterized by significant socio-economic human activity. Therefore, an urban or urbanized environment is a specific human environment that contains natural and artificial components, as well as people and their social groups.

The natural components of the city are represented by the physical environment (air, water, geological) and living organisms (except humans).

Artificial components are physical or spiritual objects that are the result of human activity: objects of artificial technogenic and spiritual and cultural environment.

People make up the socio-psychological environment − gender, age, psychological, social, professional and ethno-cultural groups. Thus, the city is an urbogeosociosystem or urbosystem for short.

Proportion of people living in the cities of the country or region is an indicator of the urbanization of that territory. In Ukraine currently every two out of three residents live in cities.

Cities are open systems in which individual elements are connected not only with each other but also with the environment. This connection occurs through the flow of energy, substances and information.

The result of the functioning of urban systems is the production of material and spiritual goods and as a consequence − environmental pollution by emissions and discharges of harmful substances, industrial and household waste.

The city is a complex system, which includes an urboecosystem (human-altered natural ecosystem of urban areas), social subsystem (sociosphere of the city) and technosphere of the city (industrial and economic complex).

Features of the current stage of socio-economic and technogenic development determine the rapid increase in urban population. At present, in large cities concentrate the production capacities of chemical, petrochemical, machine-building, metallurgical, defense, processing and other enterprises, which are sources of anthropogenic impact on the environment.

General criteria for assessing the extent of anthropogenic impact on the environment in large cities may take into account the following:

- the size of the city;
- population size and density;
- multi-storey buildings and building density;
- functionality of use of the territory;
- areas of open and green spaces;
- production economic specialization;
- level of provision by engineering infrastructure.

A huge number of people in cities need to be provided with jobs, comfortable housing, places of rest, as well as they need in watering, feeding, and disposing of waste. At the same time, the higher level of the development of scientific and technological progress, the more comfortable living conditions of the population, the stronger negative impact on the environment.

Practical lesson 7

Task: Determine individual features of the rhythm of working capacity by the method of psychological testing.

Method of psychological observation

The German physiotherapist Lampert laid special emphasis on the reactivity of the organism, i.e. the strength and speed of its reaction to external influences.

The first scientifically recognized dimension of individual differences in adaptation to the 24-h periodicity of geophysical and social environment has become the preference for timing of sleep, wake and work. It is most usually named “diurnal preference”, “morning-evening preference”, “morningness–eveningness” and “chronotype”.

Besides, two extreme chronotypes at the poles of this dimension are often nicknamed “owls” and “larks”.

The first group - «owls» - includes people with a slow and weak reaction to stimuli. These are calm, sensible people who are not in a hurry to draw conclusions and try to substantiate them, sometimes they are pedants, systematists, and they are also prone to logical reasoning and abstract generalizations. They are inert and avoidant; they are characterized by self-control; they are economic person, even stern and despotic. The working capacity of such people is often insignificant in the morning and reaches a maximum in the afternoon. It should be noted that in acute diseases in such people the temperature does not rise sharply and recovery is slow.

The second group ("larks") groups people who react quickly to external influences, in science they are the creators of new ideas. They indicate their own lines. They respond to all stimuli faster and sharper than the representatives of the first group. Quickly recover their strength and get tired quickly, able to work in the morning. They are strong and respond quickly to fever to infectious diseases; they dramatically change the general condition. These people are prone to diabetes, obesity, circulatory diseases. They are sensitive to weather changes.

One of the aspects of a person's rhythmic behavior is his working capacity. By this we mean performance indicators when performing various tasks. They require the improvement of the necessary movements as a result of perception and processing by the brain of certain sensory information. The complexity of both the sensory and mobile components of the task, as well as the difficulties in its

implementation can be different. But to study the periodicity of human working capacity usually use relatively simple tasks, one of them is psychological testing.

Task 1

1) Evaluate your capabilities by answering the questions below:

Take the Quiz

1. Is it difficult for you to get up early in the morning?
   a. yes, almost always;
   b. sometimes;
   c. seldom;
   d. very seldom.

2. What time do you usually go to bed?
   a. after 1 am;
   b. 11-30 pm - 1 am;
   c. 10 pm – 11-30 pm;
   d. before 10 pm.

3. What breakfast do you eat in the first hour after sleep?
   a. substantial;
   b. abundant but not very caloric;
   c. one boiled egg or sandwich is enough;
   d. a cup of coffee or tea is enough.

4. Remember at what time your slight irritability or minor quarrels at work and at home most often occur?
   a. in the morning;
   b. in the afternoon.

5. What could you easily give up?
   a. from morning tea or coffee;
   b. from evening tea.

6. Is it easy for you to break your eating habits while on vacation?
   a. very easy;
   b. fairly easy;
   c. not very easy;

d. I do not change habits.

7. In the morning you have important things to do. How early do you go to bed at night?

a. more than two hours later;
b. 1-2 hours later;
c. less than one hour later;
d. as usual.

8. How accurately can you estimate a period of time equal to a minute without a clock? Ask someone to help you with this check.

the time interval is less than a minute;
the time interval is more than a minute.

2) Evaluate the obtained results on a scale (Table 6.1).

3) Determine your chronobiotype by the sum of points scored:

- from 0 to 7 points - you are a "lark";
- from 3 to 13 points - indicate the uncertainty of the type. You are an arrhythmian, a "hummingbird";
- from 14 to 20 points - you are an "owl".

Table 7.1 - Chronobiotype evaluation scale based on test results

Question	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
a	**3**	**3**	**3**	**1**	**2**	**0**	**3**	**0**
b	**2**	**2**	**2**	**0**	**0**	**1**	**2**	**2**
c	**1**	**1**	**1**	**-**	**-**	**2**	**1**	**-**
d	**0**	**0**	**0**	**-**	**-**	**3**	**0**	**-**

4) Summarize the results of students of the whole group in a table (table.7.2) and determine the ratio of their chronobiotypes.

Table 7.2 - The ratio of chronobiotypes among students in the group

Chronobiotype	Corresponding number of students	Proportion of the total number of students in the group,%
lark		
hummingbird		
owl		

5) How can the results be applied to increase learning efficiency among student's group? Make adequate conclusions.

Task 2

1) Please read each question very carefully before answering. Answer all questions. Answer questions in numerical order. Each question should be answered independently of others. Do not go back and check your answers. All questions have a selection of answers. For each question place a cross alongside one answer only. Please answer each question as honestly as possible.

Take the Quiz

(Adapted from: Horne, J.A.; Östberg, O. (1976). A self-assessment questionnaire to determine morningness-eveningness in human circadian rhythms". Int J Chronobiol 4 (2): 97–110)

1. If you were entirely free to plan your day, at what time would you naturally wake up?

Score	Hours
5	**Before 6 am**
4	**6 am -7 am**
3	**7 am – 9 am**
2	**9 am – 10 am**
1	**After 10 am**

2. If you were entirely free to plan your day, at what time would you naturally go to bed?

Score	Hours
5	**Before 9 pm**
4	**9 pm – 10 pm**

3	**10 pm – 12 am**
2	**12 am – 1 am**
1	**After 1 am**

3. If there is a specific time at which you have to get up in the morning, to what extent are you dependant on being woken up by an alarm clock?

	Score
Not at all dependent	4
Slightly dependent	3
Fairly dependent	2
Very dependent	1

4. How easy do you find getting up in the mornings?

	Score
Not at all easy	1
Not very easy	2
Fairly easy	3
Very easy	4

5. How alert do you feel during the first half hour after you wake up?

	Score
Not at all alert	1
Slightly alert	2
Fairly alert	3
Very alert	4

6. How is your appetite during the first half-hour after having woken in the mornings?

	Score
Very poor	1
Fairly poor	2
Fairly good	3
Very good	4

7. During the first half-hour after having woken in the morning, how tired do you feel?

	Score
Very tired	1
Fairly tired	2
Fairly refreshed	3
Very refreshed	4

8. When you have no commitments the next day, at what time do you go to bed compared to your usual bedtime?

	Score
Seldom or never later	4
Less than one hour later	3
1-2 hours later	2
More than two hours later	1

9. You have decided to engage in some physical exercise. A friend suggests that you do this one hour twice a week and the best time for him is between 7am – 8am. Bearing in mind nothing else but your own "feeling best" rhythm, how do you think you would perform?

	Score
Would be on good form	4
Would be on reasonable form	3
Would find it difficult	2
Would find it very difficult	1

10. At what time in the evening do you feel tired and as a result in need for sleep?

Score	Hours
5	**8 pm – 9 pm**
4	**9 pm – 10:15 pm**
3	**10:15 pm – 12:45 am**
2	**12:45 am – 2 am**
1	**2 am – 3 pm**

11. You want to be at your peak performance for a test which you know is going to be mentally exhausting and lasting for two hours. Which one of the four test times would you choose?

	Score
8 am – 10 am	6
11am – 1 pm	4
3 pm – 5 pm	2
7 pm – 9 pm	0

12. If you went to bed at 11 pm, at what level of tiredness would you be?

	Score
Very tired	5
Fairly tired	3
A little tired	2
Not at all tired	0

13. For some reason you go to bed several hours later than usual, but there is no need to get up at any particular time the next morning. Which one of the following events are you most likely to experience?

	Score
Will wake up at usual time and will not fall asleep	4
Will wake up at usual time and will doze thereafter	3
Will wake up at usual time but will fall asleep again	2
Will not wake up until later than usual	1

14. One night you have to remain awake between 4 am – 6 am in order to carry out a night watch. You have no commitments the next day. Which one of the following alternatives will suit you best?

	Score
Would not got to bed until watch was over	1
Would take a nap before and sleep after	2
Would take a good sleep before and nap after	3
Would take all sleep before watch	4

15. You have to do two hours of hard physical work. You are entirely free to plan your day and considering only your own “feeling best” rhythm, which one of the following times would you choose?

	Score
8 am – 10 am	4
11 am – 1 pm	3
3 pm – 5 pm	2

7 pm – 9 pm 1

16. You have decided to engage in hard physical exercise. A friend suggests that you do this for one hour twice a week and the best time for him is between 10pm – 11pm. Bearing in mind nothing else but your own "feeling best" rhythm, how well do you think you would perform?

	Score
Would be on good form	1
Would be on reasonable form	2
Would find it difficult	3
Would find it very difficult	4

17. Suppose that you can choose your own work hours. Assume that you worked a five hour day (including breaks) and that your job was interesting and paid by results. What time would you finish?

Score	**Hours**
5	**5 hours starting between 4–8 am**
4	**5 hours starting between 8–9 am**
3	**5 hours starting between 9 am–2 pm**
2	**5 hours starting between 2–5 pm**
1	**5 hours starting between 5 pm–4 am**

18. At what time of the day do you think that you reach your "feeling best" peak?

Score	**Hours**
5	**5 am – 8 am**
4	**8 am – 10 am**
3	**10 am – 5 pm**
2	**5 pm – 10 pm**
1	**10 pm – 5 am**

19. One hears about "morning" and "evening" types of people. Which one of these types do you consider yourself to be?

	Score
Definitely a morning type	6
Rather more a morning than an evening type	4
Rather more an evening than a morning type	2

Definitely an evening type 0

2) Here's what your score means[1]:

Extreme morning type − 70-86
Moderately morning type − 59-69
Neutral (Neither) type − 42-58
Moderately evening type − 31-41
Extreme evening type − 16-30

3) Summarize the results of students of the whole group in a table (table.7.3) and draw a conclusion about the features of the distribution of students in the group by type of working capacity:

Table 7.3 − The ratio of types of working capacity among students

Type	**Corresponding number of students**	**Proportion of the total number of students in the group,%**
Extreme morning type		
Moderately morning type		
Neutral type		
Moderately evening type		
Extreme evening type		

4) How can the results be applied to increase learning efficiency among student's group? Make adequate conclusions.

Self-control questions

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?

[1] If the test score indicates that you are a moderately morning type, a neutral type of a moderately evening type, the chances are that you will be able to adapt to changes in your sleep pattern.
Extreme morning types or larks are likely to experience considerable difficulty adjusting to shiftwork.
Extreme evening types or owls adjust to changing time schedules more easily than most people.
Whether we are larks or owls tends to change as we age. Teenagers and adolescents are more likely to be night owls, and as we get older, we have a natural tendency to become morning larks.

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.

WAYS TO HARMONIZE THE RELATIONSHIP BETWEEN HUMAN AND NATURE

Basic theory

1. Global problems as a result of Human-Nature interaction;

2. The concept of Planetary boundaries;

3. Basic conceptual provisions of the of sustainable development;

4. Sustainable Development Goals (SDGs) and its implementation in Ukraine.

1. Global problems as a result of Human-Nature interaction

Throughout history there has been a limit to nature's capacity to absorb the impact of human development. In previous times, pollution and other pressures mainly resulted in the deterioration of local environments.

But now we have strained the limits of natural resilience at the planetary level as well. The world's population has grown from about 1.6 billion people in 1900 to today's 7.9 billion. During this period, technological innovations and the use of fossil energy helped meet growing demand for resources.

Most notably, in the early 1900s an industrial method was developed for fixing nitrogen into ammonia. The resulting synthetic fertilizer now sustains about half of the world's population but also causes pollution of air, water and soils.

Readily available fossil fuels provide energy for domestic use and industrial production, enabling global trade. But only at the cost of rising atmospheric CO2 concentrations and global warming.

Human activities and accompanying resource uses have grown so dramatically, especially since the mid-20th century, that the environmental conditions that fostered our development and growth are beginning to deteriorate.

It is clear that responding to risks at the planetary scale will be vastly more challenging than anything we have dealt with before.

An Earth system perspective can help us to perceive complex relationships between human actions and global impacts that affect the natural state of the planet. It enables us to see how local changes have consequences that play out at other geographic scales, and to recognize that impacts that influence one system might affect other systems as well.

2. The concept of Planetary boundaries

The Planetary Boundaries framework exemplifies such an Earth system perspective. It illustrates how global patterns of consumption and production lead to increased risk for both natural and human systems.

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.

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.

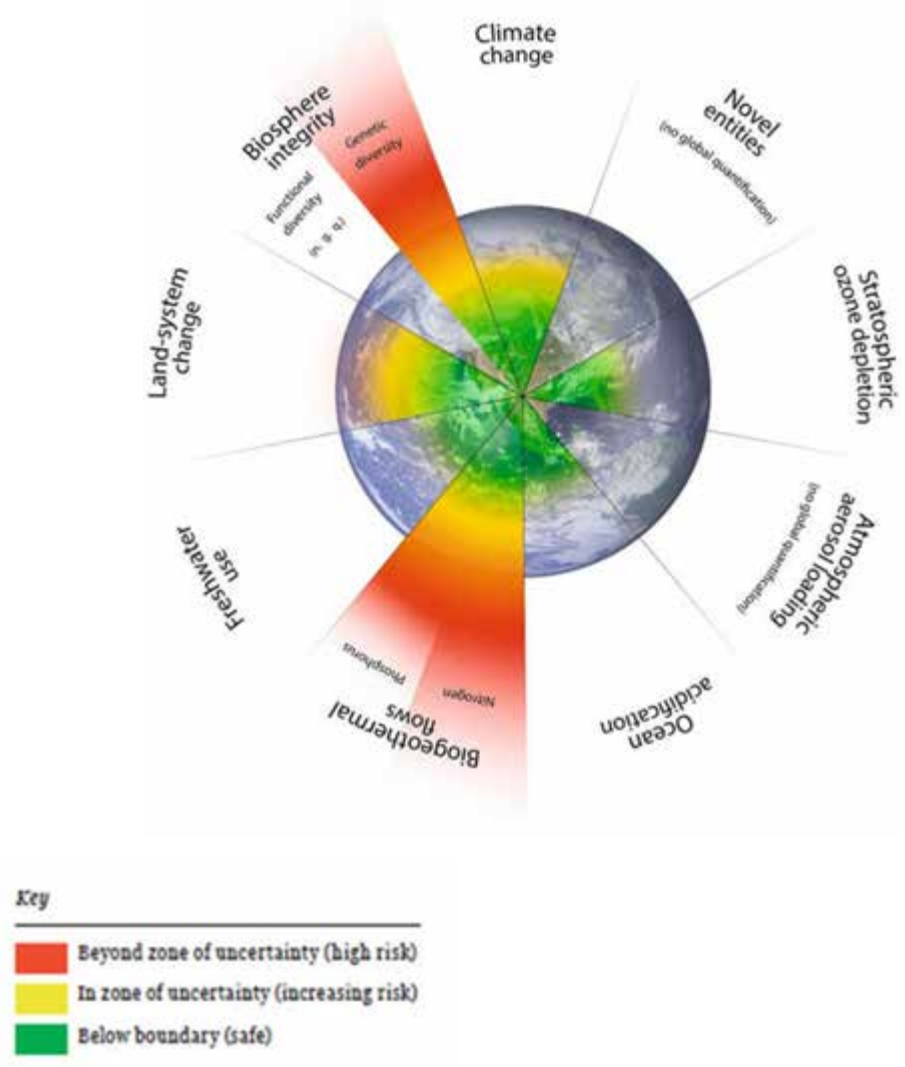

Figure 7.1 the Planetary Boundaries

Source: https://www.stockholmresilience.org/research/planetary-boundaries.html

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, fertiliser 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.

3. Basic conceptual provisions of the of sustainable development

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 strategy of sustainable development is an alternative to the economic growth paradigm, which ignores the ecological danger from the development of society according to an extensive model.

In 1987 the white paper, named Our Common Future, was published by the World Commission on Environment and Development (WCED). The document set the loose foundation of sustainable development with a widely quoted definition, which states “sustainable development is development that meets the needs of the

present without compromising the ability of future generations to meet their own needs".

The document, also frequently known as the Brundtland Report , has "since been taken up by almost every international institution, agency and NGO". The Brundtland Report became the first document to support sustainable development as a multi-disciplinary field, as it explained that the economy, society, and the environment were key to sustainable development.

In 1992, the UN Conference on Environment and Development, held in Rio de Janeiro, adopted the program "Agenda 21" and approved it as a guide to action for all countries in the 21st century.

Among the main provisions of the concept was that humanity is able to give the development of world civilization a sustainable and durable character so that it meets the needs of people living today and does not deprive future generations. On its basis, concepts of sustainable development of a number of countries have been developed and implemented.

In view of cause and effect, the general goal of the sustainable development strategy is the preservation of humanity, and the general task is to preserve the conditions under which humanity can exist and develop, i.e., to preserve the resilience of the biosphere and local ecosystems.

The main task of the strategy of sustainable development is to ensure the conditions of sustainable development of social, economic and environmental components of the system "Society-Biosphere" by forming conditions for balanced use of natural resources.

4. Sustainable Development Goals (SDGs) and its implementation in Ukraine

In September 2015, within the framework of the 70th session of the UN General Assembly, a UN Summit on Sustainable Development was held in New York, at which new development guidelines were adopted and the Development

Agenda after 2015 was adopted. The final document of the Summit "Transforming our world: an agenda for sustainable development until 2030" contains 17 Global Sustainable Development Goals and 169 tasks.

Figure 7.2 – Global Sustainable Development Goals

SDGs work in a spirit of partnership and pragmatism, and aim to make the right choices in order to steadily improve the quality of life for future generations. They contain clear benchmarks and targets that all countries must implement in accordance with their own priorities and the world's environmental problems in general. SDGs is an inclusive agenda. They eliminate the root causes of poverty and unite us to bring about positive change for people and the planet.

Ukraine, like other UN member states, has joined the global process of sustainable development. During 2016–2017, a large-scale and comprehensive process of adapting the Sustainable Development Goals to the Ukrainian context continued. Each global goal has been revised, taking into account the specifics of national development. The result of this work was a national system consisting of 86 tasks of national development.

National targets, indicators for monitoring the implementation of targets and targets for achievement by 2030 are reflected in the National Report “Sustainable Development Goals: Ukraine”. The established national system of tasks and indicators of the Sustainable Development Goals provides a solid basis for further comprehensive monitoring of the country. In total, 17 goals and 86 national tasks are incorporated in 145 regulations of the Government.

On September 30, 2019, the President of Ukraine issued a Decree "On Sustainable Development Goals of Ukraine until 2030", which supported ensuring the achievement of global sustainable development goals and the results of their adaptation to the specifics of Ukraine's development set out in the National Report "Sustainable Development Goals: Ukraine”.

In June 2020, the Ministry of Economy prepared the first Voluntary National Review of Ukraine's progress in achieving the Sustainable Development Goals. The document presents the results of the first stage of systematic work, which includes the adaptation of SDGs in Ukraine, monitoring and analysis of key trends, assessment of the degree of incorporation of SDGs objectives into strategic and program documents of Ukraine. The review provides a vision of achievements and challenges in achieving each of the 17 goals and the dynamics of their implementation.

War affects the formation and implementation of sustainable development policies in Ukraine and reinforces the relevance of some goals over others. By the start of full-scale war in February 2022, Ukraine was making steady progress toward achieving 15 of the 17 Sustainable Development Goals, and had made the most progress specifically in poverty reduction. Ukraine's Voluntary National Review 2021 showed a decline in the poverty rate from 58.3 percent in 2015 to 43.2 percent in 2018.

But these positive trends are changing rapidly: Preliminary UNDP estimates suggest that up to 90 percent of Ukraine's population could face poverty or be vulnerable to poverty if this war lasts one more year.

Practical lesson 8

Task: Get acquainted with the modern paradigm of development of the system "Society-Nature" and the stages of formation of the concept of sustainable development.

Additional Information

Various initiatives by green NGOs have developed composite or aggregate indicators which attempt to capture complex information about the state of the planet and or human use of the planet in an accessible way for the public and policy makers.

Example of these types of indicators include Ecological Footprint (an indicators designed to assess the state of the world's biodiversity and human consumption) on which WWF (World Wildlife Fund), the Zoological Society of London, and Global Footprint Network base a 'Living Planet Report' every two years (https://livingplanet.panda.org/).

The ecological footprint is a measure of human demand on the Earth's ecosystems. It is a standardized measure of demand for natural that may be contrasted with the planet's ecological capacity to regenerate.

It represents the amount of biologically productive land and sea area necessary to supply the resources a human population consumes, and to assimilate associated waste. Using this assessment, it is possible to estimate how much of the Earth (or how many planet Earths) it would take to support humanity if everybody followed a given lifestyle.

Both the Ecological Footprint and biocapacity are expressed in a common unit called a global hectare, where 1 gha represents a biologically productive hectare with world average productivity.

Since the early 1970s, humanity has been demanding more than our planet can sustainably offer. Global Footprint Network estimates that, as of 2018, humanity has been using natural capital 1.7 times as fast as Earth can renew it, which they describe as meaning humanity's ecological footprint corresponds to 1.7 planet Earths.

Learning activity

1. Take the online test to determine your individual ecological footprint at the following link (https://footprint.wwf.org.uk/#/).

2. According to the results of the test justify possible ways and reserves to reduce or optimize your lifestyle in order to balance the consumption of resources and reduce your carbon footprint.

Self-control questions

1. In what way the size and scale of the human enterprise have grown since the mid-20th century?

2. Among the Planetary Boundaries are:

a. biosphere integrity;

b. biosphere fragmentation;

c. climate change;

d. land-system change;

e. air-system change.

3. What boundaries have already pushed by humans?

4. When was the first UN Conference on Environment and Development?

5. What is the main document adopted at the Stockholm Conference?

6. Name and comment on the general purpose of the concept of sustainable development.

7. What is the relationship of environmental sustainability with other Millennium Development Goals?

8. When the Sustainable Development Goals were officially established?

9. The Rio+20 outcome document calls:

a. Multilateral Environmental Agreement;

b. The Future we Want;

c. Millennium Development Goals;

d. Our Common Future.

10. Give the short characteristic of Ukraine's environmental issues.

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