ECOLOGICAL AND ECONOMIC EDUCATION IN THE CONTEXT OF SUSTAINABLE DEVELOPMENT

(socio-economic view of sustainable development)

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The monograph is devoted to the analysis of ecological and economic condition, its dependence on social development and production activity of a person in a certain territory.

Theoretical aspects, mechanisms of implementation and principles of sustainable development of society, countries and regions are considered.

The book is designed for researchers, university teachers, teachers, students of a wide range of readers who are concerned with the problems of sustainable development of society.

ECOLOGICAL AND ECONOMIC EDUCATION IN THE CONTEXT OF SUSTAINABLE DEVELOPMENT (socio-economic view of sustainable development)

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INTRODUCTION

Scientific and technological progress related to industrial and agricultural production, rapid growth and large annual population growth on planet Earth have been accompanied by significant changes in the environment. Such activities of human activity as deforestation, irrigation and drainage of the earth, chemicalisation of agriculture, extraction and processing of minerals, increase of energy and transport capacities, space exploration and many other forms of production activity have led to irreversible changes in the biosphere of the Earth.

The rapid development of industry, all modes of transport, the intensification of agriculture, the emergence of waste from the chemical, nuclear and nuclear industries have led to significant pollution and even environmental degradation. Experts say that in recent years, the planet Earth is "working on the verge" of its biological capabilities to support human life.

The scarcity of a number of natural resources and the large volumes of their use, the rapid pace of urbanization, pollution and the resulting disturbance of natural equilibrium, unforeseen impact on living organisms - all this necessitates a rethinking of the traditional practice of human interaction with nature.

Therefore, both scientists and practitioners state that human society has acquired the capacity for self-destruction in recent decades. On the one hand, it can be self-destructive in the course of hostilities. On the other hand, the self-destruction of mankind has become possible in the process of intensive growth of production activity. The impact of the latter on the environment is irreversible. There was a situation where even the entire planet began to feel the negative impact not even of the whole regions. This led to the emergence of a number of problems that went down in history called environmental. First of all, they should include:

- the problem of population;
- the accumulation of weapons of mass destruction (primarily chemical, nuclear and bacteriological);
- the problem of household, street and industrial waste (especially poisonous chemicals, pesticides and radioactive waste);
- raising the average annual effective temperature of the planet (heat death and nuclear winter);
- the problem of raw materials;
- ozone windows in the atmosphere.

INTRODUCTION

In the interests of today's and especially the future generation, humanity needs to develop a system of measures aimed at the rational interaction of man with the environment, the conservation and reproduction of natural resources, the scientifically sound use of natural resources. In our view, such a system of measures should be implemented at different levels: interstate, state, public, industrial and individual.

At the present stage of civilization, the natural environment "works on the verge" of its biological capabilities to ensure the conditions of human life. This is due, first of all, to the fact that natural systems and the speed of their reproduction have their limiting limits, and the technogenic pressure on them increases from year to year by exponential laws.

In recent decades, human impact on nature has become particularly large, virtually uncontrolled, and in many cases unpredictable. It is quite understandable that it is no longer possible to solve environmental problems only through the development and implementation of clean and resource-efficient technologies. In many researches it is stated that the initiated process of intervention in the natural environment has turned into negative consequences: the state of the environment is steadily worsening, raw materials and energy resources are being depleted, the areas of arable land, forests, volumes of fresh water per person are constantly reduced, new problems appear - global climate change, ozone windows, radioactive waste, new diseases and more. The outlined trends and possible consequences of the coming catastrophe make society think in the beginning of the 21st century about the problems of finding radical changes in the priorities of its socio-economic development.

The principles of sustainable development of the world community were first declared by the UN Conference on Environment and Development in June 1992 in Rio de Janeiro. On which it was decided to consider the implementation of a socio-economic condition that would exclude irreversible negative changes in the environment when introducing the concept of sustainable development. This approach rejects the idea of human monopoly in nature, which has been continuously asserted throughout the existence of mankind on planet Earth. The transition to sustainable green development defines a strategy for cooperation between states in the conservation of the biosphere and the existence of the human race. Before the world, as a whole and before every country in particular, the task is to comprehensively and balancedly solve all socio-economic problems without destroying the environment and wasting waste of natural resources. Thus, the concept of sustainable development should not be viewed in terms of achieving a certain system of indicators of economic activity in the appropriate terms, but as a direction in which society, ethnicities, states, their regions, individuals, today, tomorrow and in the future should move.

As according to medical examinations today among high school students only one in ten is absolutely physically and mentally healthy person, and considering the above, we believe that the problems of nature protection, human interaction with the environment, the study of possible options for the development of human civilization should be given considerable attention in both high school and high school.

A conscious and caring attitude towards nature should be formed from childhood, in family, at school, and is possible only if ecological culture is formed and knowledge in this field is accumulated. Ecological and economic training and education is a psychological and pedagogical process aimed at the formation of knowledge of the scientific bases of nature management, non-essential beliefs and practical skills, a certain orientation and an active life position in the field of protection of natural resources.

The main task of this monographic development is to see what processes are taking place today in the natural environment, how man influences nature and what needs to be done to ensure that harmony between nature and man so that humanity does not enter the age of ecological cataclysms . The assumption is that humanity cannot stop changing nature, but it can and must stop changing the environment in a reckless and irresponsible way, without considering the requirements of environmental laws. Only when human activity will proceed in accordance with the objective requirements of environmental science, and not vice versa, will changing nature be a way of preserving it. That is why it is so important to start environmental education from an early age. The fate of our planet depends on the ecological and economic culture of the population.

The book is aimed at researchers, teachers and students of universities, teachers, a wide range of readers who are concerned with the problems of sustainable development of society.

1 PECULIARITIES OF ENVIRONMENTAL-ECONOMIC INTERACTION SOCIETIES WITH NATURE

Overcoming the ecological and economic crisis that has hit the entire planet today is considered to be a major component of national policy in all developed countries. One of the main tasks of this policy is to dramatically change the attitude of man towards the economy and nature, to form ecological and economic knowledge, culture and behavior in it. Educational institutions of all types and levels should play an important role in this process. Today's education aims to form a comprehensively-developed personality, who is first and foremost a professionally trained worker, bearer of legal and ecological and economic culture. The educational process should be aimed at ensuring that the future specialist of any field of social production is armed with the relevant legal, ecological and economic knowledge, possesses a certain ecological and economic culture and bears civil responsibility for his activity.

Environmental protection is one of the most pressing problems of our time, it has transcended national and regional borders and has gradually evolved into a global one. In human nature, this problem can be compared to the problem of ensuring international peace and security, achieving and strengthening the international tension and interstate cooperation. The ecology of the Earth is the only, and the danger that arises at one end of the planet, disrupting the world system of ecological and economic relations and relations, will threaten all humanity [25,69].

1.1 The essence and genesis of ecological and economic doctrine

Ecological reality is, first of all, a certain system of ideas about ecosystems, conditions and environmental factors in which the human life process exists and carries on. Environmental reality is knowledge about the object of ecology, which is organized and organized in some way. In the most general case, it reflects the historicity and relativity of knowledge about reality. Without scientific understanding of how the environment works, it is impossible to understand the place of man in it and to choose the optimal conditions for interaction of the community with nature. It is time to realize that no technical and social achievements will contribute to human life if they are contrary to the laws of nature. Natural ecosystems cannot be exploited and protected at the same time without knowledge of the laws of development and the maximum permissible limits of loading on them.

The desire to know nature, to have a certain knowledge of the environment and the possibilities of its use for the benefit, inherent in man from the very beginning of anthropogenesis. It is, in fact. was a prerequisite for human survival at all times. Over time, as mythology and religion begin to emerge, ecological and economic knowledge is organically incorporated into all worldview systems.

In mythology, man does not separate himself from nature, but on the contrary - identifies himself with nature. All names of mythological heroes and gods (Dazhbog, Zeus, Jupiter and others) are figuratively-conceptual embodiment of natural forces and knowledge of ancient man about nature. All myths testify to the then understanding of the fundamental dependence of man on nature.

In ancient times, the development of man of the natural world is accompanied by the creation of an independent ecological outlook, in which environmental knowledge acquires a certain importance. Already in the writings of Herodotus, Polybius, Strabo, Ptolemy and other thinkers of the time, detailed descriptions of the nature, flora and fauna of different parts of the world, their impact on the person who lives there, can be found. In the numerous works of the "father of medicine" of Hippocrates, who is also considered the forerunner of medical ecology, the idea that the physical state of a person depends on its way of life and peculiarities of the nature of the terrain crystallizes. in which she resides. In particular, in the treatise "On Air, Water and Terrain" Hippocrates argues reasonably about the dependence and determination of daily life and customs of the Scythians on the climate and landscape of their habitat. Aristotle's disciple, the botanist's father, Theophrastus (327-287 BC), who has studied and written about the effects of climate and weather on the growth and life expectancy of plants, on the impact of the environment on the development of fruits, made this opinion particularly clear. and flowers.

The emergence and development of large cities, the creation of industrial complexes, the industrialization of the economy, chemicalization and intensification of agriculture, the development of transport systems, the development of space, the oceans are accompanied by significant changes in the environment.

Due to the plowing of large tracts of land, the use of land under pastures, deforestation, the construction of canals and dams, the drainage and irrigation of land, the use of mineral fertilizers and pesticides, the extraction and use of large quantities of minerals, other activities of humanity, changes occur by nature created by the interaction of ulcers in the Earth's biosphere.

Already Jean-Jacques Rousseau (1712-1778) noted that human activity in many cases causes great, and sometimes irreparable, damage to the environment. However, by the early twentieth century, humankind had paid little attention to nature conservation. The rapid development of technology, the extremely rapid population growth, the continuous increase in economic impacts on natural ecosystems, the emergence of such unconventional technologies as nuclear and nuclear power, space exploration have forced humanity to pay greater attention to the environment.

At the beginning of the XX century, the main task in the field of nature protection was seen in the removal from the economic use of individual objects of nature, the creation of as many reserves, reserves and parks.

By the 50-60s of the twentieth century, nature protection was developing largely as a rational use of nature, and the main task was to conserve flora and fauna, economical use of minerals, land and water resources [2, 4].

Currently, the issue of solid, liquid and gaseous wastes from industrial and agricultural production comes first. Sanitary and hygiene measures are beginning to become increasingly important in nature conservation: combating air, water and land pollution. Therefore, under the protection of nature recently understand the system of measures aimed at maintaining the rational interaction of man and the environment, aimed at the conservation and reproduction of natural resources, the rational use of natural resources, preventing the harmful effects of human activities on nature [6,7].

Contemporary environmental problems have become an important factor affecting global development. Today, this influence is felt in all spheres of human life and society - in economics, politics, culture, international relations. Understanding the global significance of the environmental problem has become worldwide. Today, there has been a crystallization of the understanding that humans cannot use the riches of nature indefinitely and that disturbing the ecological balance is a deadly process for the entire biosphere. Environmental problems are the subject of research not only in the natural sciences, but also in the social sciences. There are mass movements, public organizations, including international ones, are created to protect the environment.

Therefore, the need for legal protection of the environment from unreasonable human activity is now ripe. In addition, our country is attempting to enter the world community, and we are beginning to be in real danger of severe sanctions for the damage we are doing to our neighbors - poisonous discharges into rivers that provide drinking water to a large part of the European continent; atmospheric poisoning, etc.

It is worth noting this aspect as well. Developed countries have already experienced the so-called "enrichment at the expense of nature" fever. Ecology in our country, in the conditions of emergence of a market economy, is legally disarmed, especially it concerns various economic market projects (free economic zones, entities of regional type, international projects, etc.). Therefore, the state urgently needs an ecological code, norms of direct action with economic, administrative and punitive sanctions against violators of environmental measures.

1.2 The evolution of nature and society

Humanity knows three basic forms of evolutionary development: inorganic, biological and social [15,53,56].

Inorganic evolution, from the point of view of man, proceeds extremely slowly, it is difficult to observe and study. To a terrestrial observer, the night sky, littered with billions of stars, seems motionless. However, the evolution of outer space (the transformation of cosmic matter, the emergence and disappearance of new galaxies, etc.) occurs constantly over time and continuously in space.

Biological evolution is more noticeable, intense. its easier to observe, its speed much higher. The first primitive living organisms, according to modern concepts, appeared on Earth, estimated to be billions of years old, about 3 billion years ago. As they evolved, they became the first multicellular organisms in 1 billion years. Then came the vertebrates (about 400 million years ago), later - birds and mammals (70 million years ago). Man has existed on Earth for only a few million (4-6 million) years [56].

Social evolution is even faster. The speed of development of human society is so great that the organic world seems frozen, immobile, even more so in the inorganic world. Therefore, nature cannot adapt to its increasing influence on humans.

The dialectic of the interaction between human society and nature is that humanity is an integral part of and belongs to nature, however, society throughout its existence counteracts nature, influences it as an active transformative force, which gained great power and became virtually unmanaged and unmanaged. controlled.

At the beginning of the formation of human society, the impact of nature on man was very great. Man was completely dependent on climate, vegetation and fauna. Human impact on the environment during this period was extremely small and almost insensitive to the environment. Due to population growth and especially scientific and technological progress, the pressure on nature on

the part of man is constantly increasing. The steady increase in the power, depth and multifaceted nature of the impact on the environment is an important objective law of the interaction between society and nature.

The modern man has not only adapted to nature but has already subordinated it to himself. For cold weather warm houses were built, various clothes were constructed and invented, edible plants are grown with the help of machines, chemical fertilizers and biological stimulants; hunting has been replaced by industrial livestock. At the same time, man, as a living biological mechanism, has remained almost unchanged. Like our ancestors, we need clean air, clean water, quality and complete food. Only our needs have grown significantly. That is, man has changed not as a living being - a product of biological evolution, but as a member of a human society that evolves according to its laws.

On the other hand, the dependence of man on nature has increased more recently, because we want, and, in fact, forced to take from nature, more and more. Particularly great pressure on the nature of man began to apply from the 20-30's of the twentieth century, when the scientific and technological revolution began to gain great speed, when production, energy capacity and consumption increased sharply. Today, man needs in large quantities different metals, minerals, ores, different types of energy, without which modern production, and therefore modern life is impossible. Here are some examples.

The development of science and technology leads to the expansion of geography and depth of use of mineral resources. By the beginning of XVIII century. man used only 26 chemical elements, at the beginning of XX century. - 59, and today almost all of the elements of the Periodic Table are used. The caveman consumed about as much firewood as a nineteenth-century resident for cooking and heating. - several carts per person per year. At the end of the 20th century, one resident of a developed European country had about 12 tonnes of conventional fuel burned, equivalent to several cars of firewood.

The relationship of society with the environment was particularly aggravated in the second half of the 20th century, when the enormous scale of human intervention in natural processes began to have a great impact on ecological balance. Today, almost all kinds of natural resources of land and ocean are involved in the production sphere, space exploration has begun, man has plunged into the bowels of the earth for several kilometers.

Humanity uses almost 80% of the land for agricultural and industrial production, cut down and burned 2/3 of the forests, and nearly 90% of the total growth of the main industrial fish is

caught in the reservoirs. The annual requirement for mineral resources for the average inhabitant of the planet reached about 27 tons, and water - 500 l per day. Estimates show that as a result of construction and mining, more than 5,000 km of cubic meters are moved per year. breeds, over 8 billion tonnes of conventional fuel are burned each year. During the year, 1.5.1018 kJ of heat is released from the planet's surface and about 1 billion tonnes of incomplete combustion products are emitted.

Over the past hundred years, humanity has used around 260 billion tonnes of oxygen for various production processes and emitted nearly 500 billion tonnes of carbon dioxide into the atmosphere [110]. More than 30 billion tonnes of carbon dioxide are emitted into the environment each year, and the amount of oxygen in the Earth's atmosphere is reduced by 10 billion tonnes each year. The pollution of the biosphere leads to mass deaths of animals and birds. According to the UN, 120 species of animals and birds have been permanently disappeared from the planet.

At the same time, the annual growth rate is increasing and the absolute size of the population is increasing. Over the last thousand years, natural population growth has increased a thousandfold: from 2% in a thousand years to 2.2% a year in 2000. In recent years, population growth has exceeded 100 million people a year.

Human activity, especially in places of great congestion, has a significant impact on the Earth's climate. The amount of heat generated by man on Earth has already reached almost 0.03% of the energy our planet receives from the sun. In the last 50 years, artificial energy capacity has been doubling every 10-12 years, as a result of which the temperature of the Earth's atmosphere is rising and the concentration of carbon dioxide in the air is increasing. The first reason led to an increase in the average effective temperature of the Earth by an order of 0.1 ° C, and the second by 0.6 ° C. Estimates show that at today's economic growth rate in 2025, this temperature can rise by 2-3 ° C, which in itself can lead to the melting of glaciers and the eternal snows of Antarctica. When the order of 75-80% of glaciers on planet Earth is melting, sea levels can rise by 100-120 m. As a result, another "world flood" can occur.

All this in a complex (population growth, growth of its needs, speed of development of productive forces, more intensive use of natural resources, urbanization of life in general) leads to irreversible processes in nature, causes climate change and emergence of various catastrophes: ozone windows, droughts in Africa, floods in various parts of the world, terrible hurricanes in the Caribbean, unprecedented frosts in the Eastern Mediterranean. At present, when the capacity of the environmental impact of production is doubled every 10-12 years, further disposal of production

waste in reservoirs is accompanied by pollution of the latter, since the natural process of restoring the quality of water resources no longer works.

Intense changes of the environment have acquired a crisis character and make humankind soberly assess the ecological situation and constructively approach its solution on the basis of international programs of a scientifically sound system of rational use of nature. Only the joint active activities of all the countries of the world can stop the ecological catastrophe and eventually take integrated measures to improve the ecological status on planet Earth.

1.3 Relationship between society development and exacerbation ecological and economic crisis

From the point of view of the ecological crisis in the history of the development of human society there are several characteristic periods. From the point of view of today's science, the formation of the universe began with extremely hot gas, which, due to natural disasters, has become a cluster of matter-galaxy and void - outer space. According to scientists, this was due to a huge explosion of unknown nature, after which fluctuations in the density of matter and energy led to the formation of galaxies in outer space. Life in the universe was born about 2.5-3.0 billion years ago. There are different perspectives on the origin of living matter. Materialists hold the hypothesis that living organisms have emerged as the product of decomposition of non-living organisms. Idealists and religion associate the appearance of life with the intangible beginning - "the life force", "the higher spiritual world", "the divine mind", etc. One cannot reject the view that life on our planet was brought from outside the world of outer space. Man, as a rational being, appeared on planet Earth several million years ago. Throughout its existence, humans have largely struggled for their survival, for bread, food, water, clothing and warmth [15,40].

Human impact on nature began with its appearance in the biosphere. At the very beginning of human existence, its activities had little or no impact on the environment. Hunting, fishing and harvesting a relatively small number of people for millions of years could not affect the biological basis of nature. The process of natural reproduction, roughly speaking, neutralized the predatory activity of man. At this stage of social development, the human community was characterized by its adaptation to nature, its great respect for it, its predilection for its forces and phenomena.

The domestication of wild animals and the emergence of an industry such as animal husbandry has led to a more significant human impact on nature. People began to form large groups, and finding better living conditions often forced them to relocate to other regions. The resettlement of large groups of people and animals was accompanied by fires, the destruction of

forests, flora and fauna in large areas. As a result, the borders of deserts have expanded considerably, artificial erosion processes have been added to the natural environment, and the climate has begun to change.

All this has led to the disappearance of some species of plants and animals that could not adapt to the new conditions of existence, or that were destroyed by humans. Organized livestock and nomadic lifestyles, on the one hand, have expanded humanity's ability to provide food, improve its living conditions, and on the other, have caused significant damage to the environment.

Further progress in the development of mankind has been attributed to the emergence and organization of the land use system, especially with the invention of the plow, which led to the expansion of arable land, a sharp increase in the yield of grain and other crops. Unfortunately, along with this process, land degradation began, their devastation, erosion phenomena became large-scale, processes of salinization and acidification of soils, destruction of the structure and chemical composition of the fertile layer began.

The Middle Ages are characterized by great geographical discoveries, which together with the process of cultivation of almost the entire territory of the earth's surface became the impetus for the development of the depths of the planet and their continuous exploitation. All this in the complex led to the creation of large cities, powerful centers of agricultural and industrial production. This period is characterized by the greatest human impact on the ecological system of the planet, but it was still local in nature and depended mainly on the concentration of large machine production. The transition from feudal fragmentation to the formation of large powers was accompanied by progress in the metalworking, machine building and chemical industries. But it should be noted that by the middle of the XIX century. the main sources of environmental pollution were domestic wastewater and products of combustion of various organic and inorganic fuels [15,19].

The advent of the steam engine, the development of ferrous metallurgy, coke chemistry, and the exploration of the depths of the Earth have led to a sharp increase in solid waste and wastewater. The emergence of railways, the development of the automotive industry have led to the increasingly solid source of air pollution becoming transport and its derivatives. The development of chemical technologies, especially the production of sulfuric and nitric acids, mineral fertilizers, various herbicides and pesticides, has further increased the pressure of society on nature.

The invention of internal combustion engines and their widespread use, the construction of large thermal power plants have led to both quantitative growth and a qualitative change in the composition of atmospheric pollutants. Nitrogen oxides, compounds of mercury, lead,

hydrocarbons, aldehydes, benzopyrene, etc., are released into large quantities into the air. Natural water systems are being introduced into very large quantities of phenols, pesticides, various types of lubricants, chemically aggressive and poisonous substances, including in large quantities waste from galvanic production.

In the twentieth century, when the development of the world economy began to be determined not least by the amount of extracted raw materials (coal, oil, gas, metals, ores, etc.), the ecological environment actually became a single integrated resource. Progress in socio-economic development has come into conflict with humanity's environmental goals. In developed countries, the problem of reducing man-made pressure on the conditions of life of the society and the surrounding nature is sharply raised. In poor countries, where hunger, cold and disease are fought every day, the standard of living is determined mainly by the amount of raw material extracted, that is, the degree of use of natural resources. This in industrialized backward countries leads to extremely intensive barbaric exploitation of natural resources, their extremely rapid use. Such a process is, in principle, aimed at the gradual historical extinction of these peoples. In addition, producing countries have major problems with the extractive industries, pollution and poisoning of soils, the air basin and freshwater sources, which have a significant impact on the health of the population. That is, in the modern world more and more clearly outlines the global planetary tendencies of greening of all economic activity.

The relationship of human society with the environment has especially intensified in recent decades, when human action on nature has reached enormous proportions, which has led to a shift of ecological equilibrium towards crisis phenomena. Today, all kinds of natural resources of the land, most of the ocean's resources, are included in the production sphere, man has begun the exploration of outer space. Humanity is already using almost 100% of the land suitable for rural agriculture. Every inhabitant of the planet annually extracts from the bowels of the Earth almost 27 tons of raw materials. We burn up to 3.5 billion tonnes of oil and 22 billion tonnes of coal a year. About 2 billion tonnes of solid and gaseous wastes are emitted from combustion of fuels and certain activities in one year, including: 200 million tonnes of carbon monoxide, 50 million tonnes of carbon and hydrogen compounds, 150 million tonnes of ash , 150 million tonnes of sulfur oxides, etc. [15,39].

For example, in 2004, over 670 million tons of mineral fertilizers and about 3 million tons of toxic chemicals were introduced into arable land. Experts say that from them the plant world absorbs only about 40-60%, and about a third is washed with sewage into rivers and lakes and weathered into the air. In addition, about 250,000 tonnes of various metals, including almost 18,000

tonnes of mercury, are released into the oceans each year. Due to various man-made disasters, about 25 million tonnes of oil are annually spilled into the oceans [4,110].

Man from the second half of XX century. began to constantly feel the neurotoxic effect of heavy metals, complex poisonous chemical compounds, radioactive substances entering her body in large quantities. People began to spend a large part of their lives in artificially created electric and magnetic fields of low and high power, under the influence of considerable noise and radiation fluxes.

All this suggests that, in the most general sense, the beginning of the twentieth century was marked by the emergence and onset of global contradictions between living standards, social production, and environmental quality. Economic needs and the continuous growth of material production lead to irreversible destruction and pollution and thus worsen; quality of life. A characteristic feature of our time are the general decline of morality, the rise in poverty, crime, the escalation to the critical level of the conflict between the technosphere and the biosphere. The main problems for the community arise in the following planes.

1.3.1 Clean air problems

The atmosphere is not only the air breathed by humans, animals and plants, it is also the gaseous shell of the planet, which protects it from extremely sharp fluctuations in temperature and other influences of outer space. Daily fluctuations in temperature on Earth in the absence of an atmosphere would reach ± 200 ° C. The atmosphere protects all living things on Earth from the harmful, first of all, electromagnetic radiation of the Sun and the Cosmos. The atmosphere is the environment in which the climate, rains and winds are formed, that is where the weather "is made and regulated".

It is accepted to divide the atmosphere into the following layers: Troposphere - up to an altitude of 8-17 km (depending on latitude); it contains almost 80% of the total mass of the atmosphere, here concentrated water vapor and formed the weather. The stratosphere is a layer above the troposphere that extends up to 40 km. At the top of the stratosphere is the maximum concentration of ozone (O3 molecules), which absorbs and scatters the short-wave ultraviolet radiation of the sun and protects the Earth's wildlife from its harmful effects. The ionosphere is a layer above the stratosphere, here the concentration of ionized gas molecules is increased. This layer protects the biosphere from the harmful effects of cosmic radiation. The exosphere (outer

sphere) is above the ionosphere. it is also called the scattering sphere because the gas molecules of this layer are scattered in outer space.

The exact upper boundary of the Earth's atmosphere cannot be specified, since the density of air is constantly decreasing with height as it approaches the density of outer space. Traces of the atmosphere are recorded at altitudes of about 10 thousand km or more.

At the Earth's surface air consists of: -78.1% nitrogen (by volume), oxygen - 21.0%, argon - 0.9%, carbon dioxide - 0.03%, total content of neon, helium, krypton, xenon, hydrogen and ozone do not exceed 0.01%. At an altitude of 250-300 km the main component of the atmosphere is atomic oxygen. Starting at altitudes of 500-600 km, the atmosphere becomes helium-hydrogen and the outer layers are composed of atomic hydrogen. In addition to gases, the atmosphere always contains a certain amount of water vapor and various impurities [27,39].

It is accepted to divide the sources of atmospheric pollution into natural and artificial ones. Natural pollution of the atmosphere is due to the action of street-ditches, weathering of rocks, forest fires from lightning, evaporation of sea salts, etc.

Artificial pollution of the atmosphere is created by industrial enterprises, agricultural production, transport, energy and, in particular, the mining industry. In the last 50 years there have been problems of radioactive contamination of the atmosphere and the creation of an artificial electromagnetic field.

The following pollutants are believed to be the main pollutants of the atmosphere today [44,47]:

Carbon dioxide is produced by the combustion of various organic and inorganic substances and compounds containing carbon (energy, industry, transport, heating).

Carbon monoxide is produced by incomplete combustion of coal and oil. The main sources are the metallurgical industry, refineries, internal combustion engines.

Sulfur gas is an integral part of all exhaust gases and products

combustion of domestic and industrial fuel.

Nitrogen oxide is formed in the process of operation of internal combustion engines, jet engines, domains, enterprises of the chemical industry.

Chlorine compounds pollute the air at chemical plants that produce herbicides, hydrochloric and acetic acids, organic dyes, hydrolysis alcohol, soda, etc.

Fluoride compounds are released in the production of phosphates and phosphate fertilizers, the combustion of coal, smelting of pig iron.

Ammonia is excreted in the production of ammonium fertilizers, nitric acid.

Aerosols, created by industrial plants and heating systems. They create centers of water vapor crystallization in the air, leading to the formation of artificial fogs and increasing rainfall, especially in cities where large numbers of people live and produce powerful production.

Mercury is contained in the products of combustion of various kinds of organic fuel, wastes of the paint industry, products of the pulp and paper industry, is released when the ores are enriched.

Lead - much of it is released into the air when burning gasoline, to which it is added to increase the resistance to detonation, is allocated by enterprises for the processing of lead ore and chemical industry.

Due to production activity, more than 30 billion tonnes of carbon dioxide are emitted from the Earth's surface each year, mainly as a result of fuel combustion. According to the UN, over the past 100 years, the amount of CO2 in the Earth's atmosphere has increased by more than 10%. It is estimated that if the amount of CO2 in the atmosphere doubles, the global temperature will increase by 3-5 ° C, leading to the so-called greenhouse effect.

The last in its impact on human civilization is no less a threat than the nuclear world war. It is worth pointing out that in 2000 the CO2 content in the atmosphere increased by 20-25% compared to 1990, which is 2 times more than in 1970-1980. At such rates of atmospheric pollution in 2050, the global temperature of the Earth may rise by 3-6 ° C, which will be accompanied by rapid melting of glaciers, rising levels of the oceans and a complex of other undesirable processes.

In addition, about 300 billion tonnes of oxygen have been used for combustion processes over the entire period of human activity, including 50 billion tonnes in the last 50 years. By the end of the 19th century, the use of oxygen in oxidation processes was offset by photosynthesis reactions. Today, this balance is broken. Increasing rates of fuel combustion, metallurgy, chemical and other industries use increasing amounts of oxygen. This has already reduced the oxygen concentration in the atmosphere by about 0.03%.

It is also worth pointing out that today forests cover only 38 million km. sq. m. territory, which is about 29% of the Earth's land. Experts argue that there is not enough forests to allow nature to clean itself of emissions (primarily carbon dioxide) and produce enough oxygen.

Each square kilometer of the earth's surface, depending on its industrial capacity, emits from the atmosphere of the Earth from 466 (Canada) to 24000 kg (Czech Republic) of sulfur dioxide, from 530 (Finland) to 12500 kg (Germany) - oxides of nitrogen .

The main source of sulfur oxides are metallurgical plants and thermal power plants. One medium-sized power plant, burning about 10 thousand tonnes of coal a day, in which there is about 3% sulfur, emits 1 thousand tonnes of sulfur dioxide into the atmosphere.

Today, around 70,000 different artificial chemical products are produced in the world, increasing by approximately 1,000 more each year. As a result, 2.5 billion tonnes of CO2, 300 million tonnes of CO, 200 million tonnes of N02, more than 50 million tonnes of various hydrocarbons and an additional 300 million tonnes of aerosols of various chemical composition are additionally supplied to the atmosphere. During the year, about 8,000 tonnes of mercury is extracted worldwide, about half of which is lost in practical use. Uncontrolled mercury emissions reach about 4-5 thousand tonnes per year, which is almost equivalent to the amount of mercury extracted from rocks over the same period. It is estimated that 30,000 tonnes of mercury have been released into the Earth's atmosphere over the past 25 years alone due to the production capacity of the United States [57,110].

Acid atmospheric precipitation (colored rain and snow), which are formed as a result of the formation of acid oxides: sulfur oxide (heavy industry), nitrogen oxide (automotive industry), are increasingly threatening. Oxides of sulfur and nitrogen react with water vapor and form sulfuric and nitric acids, which in the form of acid rain fall to the Earth. Through acid rain forests have become dry, the number of diseased forests reaches 30% of their total area. Sulfuric and nitric acids increase the mobility of aluminum in soil, which is toxic to the root system of plants.

In major cities, up to 80% of all pollution is accounted for by road transport. Currently, there are more than 600 million vehicles in the world, including nearly 100 million trucks and about 1 million buses. Each year, the world's car fleet grows by another 52-55 million units. The car, on the one hand, facilitates human life, and on the other - poisons it in the truest sense. One car a year absorbs about 4 tons of oxygen from the atmosphere, emitting about 200 different toxic compounds, including up to 800 kg, with exhaust gases. carbon monoxides, about 40 kg of nitrogen oxides and nearly 200 kg of various hydrogen-carbon compounds. In addition, by burning 100 kg of gasoline, the car emits about 2 kg of harmful substances into the atmosphere. A light car emits about 10 g of nitrogen oxides per kilometer. When so many harmful pollutants enter the atmosphere, it is no longer able to self-purify itself, so special technical ones are needed; economic, social and other measures to protect the atmosphere from road transport.

In developed countries, economic losses from atmospheric pollution are estimated at 3-5% of gross national product.

1.3.2 Earth and man

Earth is a human wealth. Human life is inextricably linked to the earth, the fertile soil that today produces 90% of human food. The situation with food, and therefore the socio-economic situation in society, is largely determined by the total area and quality composition of fertile soils. The state of land resources and their use is of great concern [25]. In large areas, fertility is reduced and land degradation occurs, mainly due to erosion, salinization and man-made congestion. In addition, as the population grows, there is a need not only for agricultural products, but also for the allocation of land for non-agricultural needs: for the construction of new cities and villages, factories, laying roads, pipelines, for navigable and irrigation canals, reservoirs, for hydro - and nuclear power plants, power lines, military installations and. Under the action and at will of the person the composition and structure of the soil changes, the factors of formation of fertile soil change - relief, microclimate, new seas are created - large reservoirs, new river channels appear, billions of tons of soil are mixed, etc. The use of mineral fertilizers, on the one hand, significantly increases the yield, and on the other - when overuse, can significantly affect the chemical composition of fertile soil. Treated soils are not only the result of complex natural processes, but also the product of centuries-old human activity. Along with the crop, a person removes a large amount of organic and mineral substances from the soil. For example, with potatoes at a crop of 136 c from 1 hectare, 48.2 kg of nitrogen, 19 kg of phosphorus and 86 kg of potassium are harvested from the soil. Almost as much, and twice as much potassium, is carried out from the soil with the growth of sugar beet leaves. By introducing mineral fertilizers into the soil, increasing its fertility, a person also influences the structure of soils. That is, modern cultivated soils can be considered to some extent artificial, having no analogues in the past history of the planet. Industrial and agricultural intensive production leads to changes in the properties of the structure and processes that create fertile soils. Large areas of fertile soil are occupied by industrial, household, agricultural and other wastes. A large area of land is lost every year as a result of improper land reclamation, swamps and irrigation processes: Plowing land under crops, people and machinery each year move a mass of soil with a volume of 4,000 km3, three times the amount of volcanic products that rise from the depths of the planet in a year.

In this connection, it is advisable to consider how modern civilized people use land resources today [25,76]. The total surface area of the planet is approximately equal to 517 million km2. It consists of the surface of the oceans - about 375 million km2 and land - 135.8 million km2.

The total land area can be conditionally divided into the following major, in terms of human existence, groups:

- arable land - 14.5 million km2 or about 11% of the land area;
- pastures and hayfields - 31.0 million km2 or 23%;
- forests - 38.0 million km2 or 29%;
- deserts, swamps and glaciers - 44.0 million km2 or 33%.
- urbanized land (construction of various residential and industrial purposes) -5.0 million km2 or 4%.

From the above data, it follows that one inhabitant of the planet Earth today accounts for about 2.4 hectares of land, including arable land of about 0.26 hectares.

Arable land is extremely unevenly distributed across continents and countries. For example, in Australia, each person has white per hectare of land, in Russia - almost 1 hectare, in Ukraine - 0.85 hectares, in Egypt - 0.06 hectares, in Japan - 0.04 hectares, in China - 0.02 ha, etc. Due to the erosion, due to the very high rates of urbanization of society, mankind annually loses agricultural land. In recent years, this value reaches 60-70 thousand square kilometers. Today, 5.0 million km2 of land is occupied under construction, communications, airports, roads. The area occupied by cities in the late 60's was equal to 4.0 million hectares. It is estimated that by 2050 the urban population will reach 6.5 billion people and urban areas can occupy up to 100 million hectares. due to the urbanization process, up to 8 million hectares are transferred to the non-agricultural land [76]. For example, the area of irrigated land in the world reached the value of 3.1 million km2, at the same time, the value of written-off reclaimed land reached an astronomical figure of 30 million hectares. It is alarming and a very large percentage of plowed territory. In the United States, this figure reached 21%, in Western Europe about 33%, and in Ukraine nearly half of the country is torn down. That is, we can conclude that in the future, it is practically not realistic to increase the amount of land used for agricultural work. It is no longer possible to prune, prune and burn forests, as man has done throughout his life. Science claims that if forests become less than 40% of the total area inhabited by humans, then problems with wastewater begin. Water begins to disappear from the surface of the earth - rivers ripple, swamp lakes dry, groundwater levels decrease. At the same time, more often in spring and autumn there are floods, floods. This process is especially intense in mountainous and mountainous areas, where rivers often go offshore and cause great damage to the economy and nature.

Forest area today has decreased to 29% of land, which means that people are beginning to have problems with clean air. The natural laboratory for the implementation of photochemical

synthesis and for the reproduction of pure oxygen has sharply reduced its capacity. At the same time, emissions into the atmosphere of harmful substances, including oxides - CO, CO2, NO, NO2 - are increasing year by year. A situation has arisen when the forest can be industrially cut only in the Russian taiga and in the Amazon. Yes, and in principle: one tree is cut down, two need to be planted, because otherwise humanity is inevitable; there will be problems with oxygen.

It should be recalled that in the 60-70s of the twentieth century, mankind was optimistic about its capabilities and hoped for progress in the transformation of deserts in fertile land. Particularly intensive research in this area was carried out in the Middle East. These countries have virtually no arable land, and at the time have received large profits from intensive oil production. Years of hard work and heavy material costs have yielded a negative result. It turned out that if a person "conquered" a certain area of the desert from nature and turned it into fertile soil, then the desert necessarily in another place took the same, or even larger area of fertile land and turned them into sands. It can be assumed that the desert is needed by nature for certain regulatory processes that are unknown to us today. Due to the deserts, it is still not possible to increase the large area where agricultural work can be done [23-25]. On the contrary, every year, as a result of desertification, humanity loses about 20 million hectares of land suitable for agricultural work. According to UN experts, to suspend this process, up to $ 50 billion should be invested in "anti-desert" measures by 2010. Human activity has already led to the growth of deserts in an area equal to the area of Brazil.

In the last century, humanity has invested a great deal of money in draining the swamps. But it turned out that this process also has two sides. As a rule, in the first 20 years, the dried up lands give quite large yields, and then begins the process of salinization, or acidification of the soil, its erosion, the formation of beams. In addition, reducing the water surface is detrimental to flora and fauna.

It is necessary to state that in the whole history of mankind, about 20 million km2 of land has been destroyed and degraded, which is much larger than the area of all arable land used today.

All this has led to the average cost per hectare of arable land rising to: $ 200 million in Japan, $ 400 million in the United States.

So we come to the conclusion that at the beginning of the XXI century. significantly increase the area of agricultural land (arable land, pastures, hayfields) is almost impossible - humanity for the production of products

nutrition already in the twentieth century involved the largest possible area of planet Earth.

1.3.3 Water and man

Water is in all layers of the biosphere, its presence is one of the basic conditions for the origin and existence of life on Earth. Water in nature exists in three states: solid (ice, snow), liquid and gaseous (vapor). Water is a necessary component of all living organisms. The human body consists of 60-80% water, animals - 60-70%, fish - about 80%, algae, vegetables and fruits contain up to 90-99% water, etc. In the absence of water, life ceases, with its lack of reduced crop yields and reduced productivity of animals. Hence the eternal desire of man is to conserve water resources, to provide himself with sufficient clean water.

The set of oceans, seas, lakes, the year, marshes, and groundwater is the hydrosphere, that is, the water surface of the Earth, located between the atmosphere and the solid surface of the Earth's crust (lithosphere). Oceans and seas occupy almost 3/4 of the earth's surface and contain about 94% of the total amount of water on Earth. The remaining 6% is groundwater (salty and fresh), glaciers, lakes, rivers, soil and air moisture [19].

The table shows the steady reserves of water in individual parts of the hydrosphere. For practical human tasks, the most important are the reproducible freshwater resources.

Table 1.1.

Water distribution in the hydrosphere

№№

pp. Parts of the hydrosphere Volume

(thousand km3)% of the total

quantity

1. World Ocean 1370323 93.96

2. Groundwater, incl. zones of active water exchange 60000

4000 4.12

0.27

3. Glaciers 24000 1.65

4. Lakes 280 0.019

5. Soil moisture 85 0.006

6. Atmospheric vapor 14 0.001

7. River water 1.2 0.0001

8. All hydrosphere 1454703 100

1.3.3 Water and man

The waters of the oceans are the source of all the water on Earth. All parts of the hydrosphere are interconnected in a single natural cycle. Its driving force is solar energy. It is estimated that about 875 km3 of fresh water evaporates from the salt and water of the ocean and seas per day. They, condensing in the form of precipitation (rain, snow, hail), fall to the Earth's surface. About 4700 km3 of water flows into the oceans from the mainland per year. This figure includes groundwater runoff (2260 km3), Antarctica ice runoff (2310 km3), Arctic island runoff (701 km3). Daily freshwater river runoff is estimated at about 106 km3. The amount of fresh water as a whole is estimated at about 40 thousand km3, or 2.5% of all water supplies on Earth. At the same time, most freshwater (68.7%) is in glaciers and in the snow cover of Antarctica.

Water use is increasing year by year. It is considered that no more than 30% of the average annual runoff may be used. Otherwise, the average water level begins to decrease and floods become more frequent. Water consumption for household and household needs ranges from 100 liters in rural areas to 200 liters in cities, and in large cities such as Paris, Moscow and up to 800 liters per day. Especially much water per capita is used in the United States. According to [110], the average water needs of a US resident today are as follows:

Table 1.2.

The need for water per capita in the United States

№№

p / p Purpose Volumes of water, l.

1. Irrigation and other agricultural needs 2600
2. Production of electricity 2300
3. Industry 1400
4. Household needs 570

Very large quantities of water are used in industry. Melt of 1 ton of steel requires 200 m3 of water and 1 ton of nickel - 4000 m3 of water. Production of 1 ton of paper requires 100 m3 of water and 1 ton of synthetic fiber - 5000 m3 of water [21]. Even more water is used in agriculture, especially for irrigation and irrigation needs. Up to 15 thousand m3 of water should be used for irrigation of 1 ha of irrigated land. As water losses at surface irrigation are very large (due to runoff, evaporation and deep seepage, up to 50% of water is lost), it is advisable to replace low-productive and labor-intensive irrigation on furrows with drip and soil irrigation. The latter is done by supplying water directly to the root system: plants. This does not create a crust in the soil, preserves

the soil structure, reduces the amount of weeds. The absence of an irrigation grid on the surface of the fertile soil creates optimal conditions for mechanized cultivation of the field. In general, 150 people (in underdeveloped) to 800 liters of water in economically developed countries are consumed for one person per day. For example, in 2004, humanity used almost 7,000 km3 of water for personal use in industry and agriculture. Of course, after use, this water has returned to nature, but contaminated. Man wants to take pure water from nature, and returns the contaminated water. When humanity used relatively small amounts of water, nature returned water could purify. Today, when almost 1/6 of the total amount of fresh sewage is used in a year, it is not completely purified. That is, in the reuse we receive from the nature already polluted water. The degree of purity of the water used is determined primarily by the public's attitude to the problem.

Population growth, rapid development of industry, agriculture and transport not only lead to a sharp increase in water demand, but also to extremely large pollution of the oceans. The largest modern sources of pollution of the oceans are transport, oil and ore, river runoff, sewage of cities and industrial enterprises, agricultural wastes, and toxic atmospheric inputs. Particularly severe pollution occurs in reservoirs with limited water exchange, including in the Mediterranean, Black and Baltic Seas. Today, man discharges into the river, the sea and the oceans the toxic waste of chemical enterprises, metallurgical plants, phenols of coke production, diesel oils, pesticide waste of agricultural production, metals and abrasives. Oil and petroleum products are the major source of pollution of the oceans. During the year, humanity transports about 1.5 billion tonnes of oil from one end of the planet to the other end. It is estimated that as a result of accidents at sea (about 30-50 oil tankers endure accidents annually), railways, land, oil pipelines, when filling and unloading large tanks, oil wells erupt and result in Oceans 25-30 million tons of oil. The largest offshore accident occurred on March 23, 1989, when a Valdez tanker hit a reef off the coast of South America and 0.5 million tonnes of oil spilled into the sea. The oil slick spilled over 2500 km2 of seawater and covered 800 km of coastline with toxic, sticky and viscous fluid. Biologists say that the environmental impact will be manifested from this accident within 20-30 years. The last major worldwide oil pipeline accident took place in October 1994 in the Komi Republic of the Russian Federation. During the accident, more than 200 thousand tons of oil were poured into the environment. Part (10 thousand tons) was neutralized, and the rest fell into soil, ground water and river water. Nature's damage is estimated at hundreds of millions of dollars. One drop of oil is able to cover a transparent film with a thickness of 0.01 mm to 20 m2 of the sea surface, it 2-3 times reduces the water exchange between the ocean and the air, destroys microorganisms, fish, seabirds. Heavy metal ions, pesticides, and other harmful substances accumulate in the oil film. At the same

time, many marine organisms stage larvae pass in the surface layer of water. For many of them, the action of oil for several seconds is deadly. It is known that at petroleum concentrations of 0.01 mg / l the number of stillborn fish larvae increases to 50-60%. A concentration of 1 mg / l is considered deadly for marine primitive organisms. During the year, due to the inability to dispose of industrial waste, civilization discharges about 18,000 tonnes of mercury, 22,000 tonnes of lead, 35,000 tonnes of zinc, 40,000 tonnes of copper, etc. into the ocean. Most of these elements are non-decomposable. These are the states There is a particular danger to life in the marine environment. French researchers have found that the bottom of the Atlantic Ocean is contaminated with lead up to 100-200 km from the coast and at depths of up to 1600-3000 m. The world-renowned French scientist J. Cousteau claims that from 1950 to 1980 the "intensity of life" decreased to 550 - 50 m layer of seawater. Hundreds of species of fish, corals and other inhabitants of the deep sea have disappeared forever. The ocean's ability to produce oxygen is also greatly undermined [19,83].

Every day, passengers of sea-going ships throw about 0.8-1.2 million plastic containers into the oceans. For example, the beaches of New Zealand count up to 100,000 pieces of plastic of varying size on every kilometer of coastal area. On one of the islands, the US National Marine Service collected 600-700 kg of plastic on a 1.5 km long beach.

As an example, it is estimated that about 200,000 tonnes of petroleum products are drained into the South Sea. The rivers bring in about 80,000 tonnes of oil, and precipitation amounts to about 10,000 tonnes, and another 105,000 tonnes of oil comes from marine sources (accidents, catastrophes, washing of diesel engines, holds, etc.). As a result of economic activity in Germany, England and other countries, 2.0-2.5 million tonnes of titanium dioxide production waste, 0.8 million tonnes - aluminum, 0.6 million tonnes of copper and its compounds are released into the South Sea, up to 0.5 million tonnes - waste from the chemical industry, up to 5 million tonnes - household waste from large cities, 1.5 million tonnes - empty mine rock, about 1 million tonnes of ash from TPP operation. Only in 1987 from the Rhine River to the South Sea: lead - 248 tonnes, cadmium - 13.8 tonnes, mercury - 3.9 tonnes. Through the air flows during this time, the sea received: lead - 7400 tonnes, cadmium - 240 tonnes and mercury - 30 tons [3,9].

Life on the planet is threatened by actions to turn the oceans into a landfill of chemical and radioactive waste. So, right after the end of World War II, many poisonous gas and radioactive waste containers were lowered to the bottom of the Arctic Ocean. Chemical poisonous gases contained in metal and plastic containers at the bottom of the ocean are enough to poison all the living things on planet Earth several times. In the Pacific and Atlantic oceans, periodically nuclear countries flood obsolete submarines with waste of radioactive substances and nuclear fuel [19].

As a result of all these factors, humanity has found itself in a situation where its 1/4 part is no longer lacking in fresh fresh water and about 500 million people are suffering from diseases caused by water deficiency or its quality. Particularly difficult is the situation in rural areas of underdeveloped countries, where more than 3/4 of the population, which is almost 2 billion people, are no longer provided with sufficient fresh water.

1.3.4 Forest and man

Forest is one of the important components of the biosphere, it plays an extremely important role in the circulation of substances and energy, in human life. Wood has become not only a source of wood, but also a major factor in the conservation and improvement of the environment. Forest is of great importance not only as an important natural component of the atmosphere and the biosphere, but also as a source of valuable natural resources. Forests account for 80% of all land phytomass; they annually bind 65% of the energy of all land phytocenoses. Forests annually assimilate 30-35 billion tonnes of CO2, producing 20-25 billion tonnes of organic matter [78].

One hectare of forest is inhabited by soil animals (worms, beetles, other protozoa) with a total mass of about 1 ton. This is more than the mass of all terrestrial animals in the same area, counting animals and large birds. A large army of microorganisms (1 ha of forest soil about one and a half tons of bacteria and 1.0-1.2 tons of microscopic fungi) is constantly working to decompose organic residues and return to the soil the mineral salts required by the plant world.

Forests have a direct effect on the amount of evaporation, surface and inland drainage, as a whole, on the water balance. In forested areas, groundwater evenly replenishes rivers and streams throughout the year. In areas where deforestation is felled, especially in mountainous areas, 70-90% of the precipitated rainfall flows down the surface of the earth. With forest cover of -20%, the surface runoff is only 25%, and with forest cover of 60-80% it is only 7% [26].

Forests do an important job of maintaining high air quality. The oxygen produced by forests is better than that produced by plankton in the oceans, because it is enriched with negative-charged ions, which have a positive effect on the human body. In coniferous forests an average of 30 tonnes / ha is produced per year, in mixed -16 tonnes / ha of oxygen.

The forests also do a great job of clearing the contaminated water. Sewage that has passed through forest areas several kilometers, reduces the number of impurities by thousands of times, increases transparency, improves taste and smell. The content of nitrate impurities is reduced by 25-60%, pesticides by 30-40%.

1.3.4 Forest and man

Forests purify air, water, regulate water runoff, protect soil from erosion, assimilate large amounts of solar energy, that is, have a positive effect on many processes for optimizing the biosphere as a whole [29].

The annual chemical energy of photosynthesis products is 100 times greater than the energy produced today by all power plants in the world. Since photosynthesis has been taking place for over a billion years, it has allowed nature to synthesize large quantities of organic substances - in the form of oil, gas, peat, etc. Thus, forests play a major role in the circulation of substances in nature and especially in the regulation of the gas composition of atmospheric air. In addition, forests protect soil and water resources. At watersheds forests protect soils from erosion, delay surface water, replenish groundwater reserves. This is where the main contradiction regarding the problem of forest use lies. On the one hand, they need to be protected to maintain natural balance, and on the other - every year there is a growing need for forest resources, especially in the tree. Currently, about 21 thousand different products and substances are produced from wood. Among the most commonly used types of raw materials, the tree is the third most important coal and food raw material. Therefore, every year the forests are becoming smaller and smaller, and their intensive destruction has begun. about 10 thousand years ago, when a person started farming. Man has been destroying forests for several millennia. Initially, forests were cut down in very large areas of northern and eastern China, India, later in western, central and eastern Europe, then in North America, partly in Africa and South America.

At the same time, full-fledged forests are the most highly developed and complexly organized components of the biosphere. At least 20-30% of all living species are concentrated in wet tropical forests alone organisms from existing on Earth. These forests are the largest barns of the gene pool of the biosphere.

Forests have the ability to absorb solar energy in large quantities This explains their high productivity and high overall phytomass. With the development of handicrafts, the forest began to serve as the main source of fuel, in the whole of the previous 10 thousand years humanity has destroyed 2/3 of the forests (about 80 million km2). Today, forests on the surface of the land cover an area of about 38 million km2, meaning that the forest cover is less than 30% of the land. Annually, more than 3 billion m3 of forest is cut down in the world, by 2010 this amount will grow 1.5 times. Today, the world's forests disappear at a rate of 40 hectares per minute, or annually cut down 8 million hectares of forests. This barbaric attitude to the forest has led to all kinds of catastrophes: severe soil erosion, frequent sandstorms, heavy floods and drought in large areas, for example, causing the Sahara Desert to extend its borders south at a speed of 1.6 km per year.

Man quickly reduces the phytomass of forests. But despite this, they account for the bulk of planetary biomass. Of the Earth's residual phytomass (1300 billion tonnes, in dry form), forests account for 1095, ie 84.2% (tropical forests - 36.5%, evergreens, deciduous forests, -18.5%, mixed forests - 3, 2%, taiga - 23%). Natural non-forested areas and cultivated vegetation have a phytomass of 15.8% [48]. Over the last two hundred years, humanity has reduced (burned) the phytomass of the Earth by about a quarter, leading to the release of large amounts of carbon. Therefore, the concentration of carbon dioxide in the air has increased dramatically. This is accompanied by an increase in the average temperature of the lower atmosphere, the degradation of glaciers and climate change in general. Here are some examples. In Greece, forests occupy 65% of the territory, and today - 15%: Spain, in the past completely covered with forests, left 12%. Madagascar has cut down 9/10 forest areas in the last five centuries. In England, only 5% of forests remain. In Italy, Belgium and the Netherlands 8-10% Today, the forest can still be cut in the Russian taiga and in the Amazon. In general, the situation with the forest is such that, having cut down one tree, one must plant two. Otherwise, in the biosphere, the amount of pure oxygen will sharply decrease, the carbon dioxide content will increase, there will be very big problems with clean water and many kinds of organic and inorganic raw materials.

1.3.5 More important natural resources

Natural resources are those necessary components of the existence of human society that exist in nature, regardless of human being or reproduced in the process of production. That is, it is a variety of raw materials and minerals for all industries. Foods that are grown by humans are also created through the use of natural resources and solar energy.

Mineral resources. Today, natural resources are the backbone of industry development and are characterized by the total mass of mineral resources extracted from the earth's interior. The whole range of minerals located in the bowels of the earth, called mineral resources. They are the basis for the development of virtually all sectors of the economy - metallurgy, energy, construction, chemical industry, etc. The presence of mineral resources largely determines the economic potential of the modern state and significantly affects the welfare of its population. Today, about 20% of the total number of employees are employed in the mining industry, and up to 40% of fixed assets are concentrated here.

Analysis of the development of the world economy shows that in recent years there has been a rare increase in mineral extraction. Never before have raw materials, especially oil, natural gas,

coal, metals, fuel for nuclear and nuclear power, had such an impact on the economy as they have today. Suffice it to say that as early as 2000, the world production of oil reached 3.5 billion tons and gas - 2.5 trillion m3.

In total, the annual production of various rocks from the bowels of the Earth has reached 175 billion tons. Over the last 20 years, the world has processed as much raw material as in the previous history of mankind. One inhabitant of the planet is required to produce 27 tonnes of fossils each year. It is estimated that at the current rate of development in 2020, this value will reach ~ 450 billion tons. It is estimated that for the XIX century. mankind from the bowels of the Earth produced: about 23 million tons of lead; 12 million tonnes of zinc; 10.6 million tonnes of copper; 27.5 thousand tons of aluminum; I30 thousand tonnes of silver; .11.5 thousand tonnes of gold, etc. In the XX century. the extraction of base metals has increased more than a thousand times, and in the future 20-30 years will increase another 103 times [21,56].

Today, 80% of the world's industrial output is made from minerals extracted from the Earth's interior. The main natural resources are wood, oil, gas, coal, metal and non-metallic ores and others.

Total reserves of basic natural resources for 2000 are estimated as follows:

natural gas - 350 trillion. m3;

oil - 400 billion tons;

coal - 14.8 trillion. t;

iron ore - 360 billion tons

About 4,000 coal pools have been discovered on Earth, most of them in the Northern Hemisphere of our planet. The major part of all coal reserves is concentrated in 10 large basins: Tunguska, Taimyrsk, Lensk, Pechora, Achinsk, Kuznetsk, Donetsk, Rursk, Apolagsk, Ilionskoye.

There are more than 600 known oil and gas reservoirs, and their main reserves are also located in the Northern Hemisphere. Almost 60% of the world's oil exploration resources are in the Middle East: Saudi Arabia, Kuwait, Iran, Iraq and others. Oil is produced in 75 countries, and gas in 60 countries.

The area of our planet is about 517 million km2, but almost 72% of its territory is occupied by the oceans.

Land resources. Land resources (excluding Antarctica) are 137 million km2, but their structure is very different. Arable land (arable land, orchards and plantations) occupy 14.5 million km2 (about 11% of land), hayfields and pastures - 22.0 million km2 (23%); forests - 39 million km2

(29.5%) low-productive and unproductive lands (swamps, deserts, glaciers, etc.) - 44.0 million km2 (33%), urban areas (settlements, industrial, transport and military production) - 4,5 million km2 (4%). .

In 1980, an average of 3 hectares of land per 1 inhabitant of the planet, and today only 2 hectares. The value of arable land decreased from 0.45 ha per person in 1961 to 0.25 ha / l in 2000, grassland from 0.98 to 0.56 ha / l, and forests from 1.35 to 0.72 ha / l.

Water resources. The total volume of the Earth's hydrosphere is 1.4 billion km3. Freshwater resources, which are primarily needed by humans, animals and plants, account for only 2-2.5% of this volume. Of these waters, the so-called sewage is the most accessible for human beings, its amount is estimated at 41.2 thousand km3, it is distributed very unevenly across the continents and individual countries.

Plant resources. Among the plant resources in the first place allocate forest. Forests cover an area of 39 million km2. The total stock of wood is estimated to be close to 350 billion m3, with an annual increase of 5.5 billion m3 in this area. The world's forests create two large forest belts, the southern and the northern, each accounting for approximately half of the forested area and timber reserves.

Oceans resources. The main ocean resource is seawater, its volume is 1370 million km3 or 96.5% of the entire hydrosphere. Today, almost all of bromine, 1/2 magnesium, 1/3 of table salt is obtained from seawater.

Ocean energy resources are created by the energy of sea tides, ocean currents and waves, the difference in surface and deep water temperatures.

The biological resources of the ocean include animals and plants that live in the ocean. Ocean biomass is about 35 billion tonnes and accounts for 140 thousand species. Of the total mass, fish account for 0.5 billion tonnes.

Natural and recreational resources. These include objects and phenomena of nature that can be used for recreation, tourism and healing. These are primarily sea beaches, shores of the year and lakes, mountains, forest areas, mineral springs, thermal waters, etc.

Natural resources can be classified on different grounds. An important criterion for nature conservation is the extent to which they are exhaustive and the potential for recovery.

The following mineral resources are distinguished by the properties of completeness and reproducibility:

1.3.5 More important natural resources

1. Practically comprehensive and non-renewable. These are oil, natural gas, coal, most of the ores of ferrous, non-ferrous and rare metals, as well as mining, chemical, technical and non-metallic raw materials.

2. Practically comprehensive and restorative. These are peat, sedimentary salts of the gulf, separate river and sea placers, iron-manganese concretions of the ocean floor and others.

3. Almost inexhaustible. These are common water resources, clay, limestone, sand, natural stone and other building materials.

The most important minerals belonging to the first group (primarily combustible) are characterized as absolutely restricted in the earth's crust. With modern extraction scales, their reserves are rapidly depleting, and the process of geological reproduction is very slow. In addition, in the past the formation of some minerals and contributed to the geological conditions. Thus, in the Precambrian there were favorable conditions for the formation of giant iron ore deposits, in the Carboniferous - for coal, in Mesozoic and Cenozoic - for oil. The uniqueness of these conditions means the uniqueness of such deposits.

The second group includes minerals, which are relatively quickly reproduced in modern conditions. For example, a noticeable layer of peat recovers in a hundred years. Manganese nodules grow at a rate of about 1mm over 2 thousand years, but the total increase in their mass per year can be millions of tons.

The third group includes minerals, which in the earth's crust are many, enough for humanity for a great historical time. These are varieties of construction mineral raw materials, as well as carbonate, metallurgical and chemical raw materials. However, their development is limited by the use of large areas, usually occupied by arable land.

In the course of human economic activity, the components of mineral raw materials do not disappear, but are redistributed, primarily by dispersion in the natural environment. Metal, for example, is already lost in the process of enrichment and smelting with smoke, dust, runoff. In addition, metal products eventually wear out, wear off, corrode, etc. Iron is the best example of man-made scattering. About 20 billion tons of iron have been smelted in human history, and in modern facilities, machines and mechanisms it contains only about 6 billion tons of iron. tons of iron on Earth. Technogenic scattering is also characteristic of all other metals and elements extracted from the subsoil [110]. But the extremely heavy use of raw materials can cause renewable resources to become non-renewable. The resources of the subsoil are reproduced in the earth's crust by natural processes very slowly, and the rate of their extraction is extremely high, so they can be counted with non-renewable resources. Many, forested areas once turned into cities and even

deserts. A large number of animals that have disappeared in the process of evolutionary transformation will never reappear on Earth.

The inexhaustible resources include the cosmic types of energy (solar radiation, the energy of the moon and the sun, which causes the ebb and flow of water in the ocean), the energy of climate (air, wind, precipitation) and energy of water. This division is relative, although the global water reserves are inexhaustible, but its uneven distribution and significant pollution have caused considerable problems in its use in recent years. A similar situation with the oxygen that is in the Earth's atmosphere, which today can still be considered an inexhaustible resource.

A group of relatively reproducible resources should also be identified - the fertile soil that nature has been creating for millennia. Man has learned to create fertile soil artificially and quickly, but in relatively small quantities, which the needs of society are not yet able to meet. That is, when referring to the exhaustiveness or non-renewability of natural resources, both mineral and other, it should be borne in mind that these concepts are relative. Therefore, humanity is in a situation of "raw hunger" on the main types of minerals. Today, besides precious metals, first of all gold and silver, there is not enough copper, lead, tin, etc. Particularly big problems have arisen with energy resources, according to experts at the current rates of oil use will last for 40 years, gas for 70, and coal for 100-150 years. At the same time, due to imperfect technologies, -8-10% is used from the extracted raw materials and the rest goes to waste. In 2000, solid waste from the extraction of minerals reached an astronomical value of 90-100 billion tons (in 1970 this amount was still at the level of 40 billion tons). -800 billion m3 of contaminated water was discharged into rivers, lakes and seas. In addition to industrial pollution, humans still leave behind up to 500 kg per year of so-called household waste (food waste, street garbage, etc.). All this in the complex occupies very large areas of the Earth's surface and, as a rule, fertile land.

The protection of mineral resources does not imply the introduction of restrictions on the extraction of minerals or their conservation, as provided for the protection of wildlife. The essence of subsoil protection is to provide the most complete and rational scientifically sound use of mineral resources, to reduce their losses, and to prevent damage.

It should be noted that such a feature in the extraction of minerals. In recent years, the extraction of mineral resources has been increasing in developing countries, and in developed countries - decreasing. Hence the territorial disparity between the sources of mineral resources and their consumption areas. In developing countries, 55-60% live in this population of the Earth, about 80% are extracted here, and only 8-10% are consumed. mineral raw materials. These countries play the role of raw material appendages of industrialized nations.

Such a powerful human intervention in the bowels of the Earth makes it irreversible

impact on nature as a whole. Extraction of large quantities of minerals, pumping of groundwater, oil and gas, creation of underground storage and

communications, pumping into the ground of industrial waste that man does not

has where to store on the surface of the earth - all this leads to irreversible

geological processes. In many cases, agricultural lands, forests are destroyed, the structure of fertile soil changes, and changes

terrain, changing air currents, gaseous, liquid and solid wastes polluting the earth, air and water spaces.

About the huge scale of processing of rock mass during opening

deposits indicate that the volume of empty rocks in our country is close

2 billion tons annually. On the manganese ore quarries of Ukraine to get

And a ton of ore, removed up to 40 tons of rocks. Extraction of raw materials from the bowels is accompanied by mining and robots that leave behind dumps

empty rock. The total area of disturbed land is about 300

thousand hectares, which is allocated annually for the needs of the mining industry

7-8 thousand hectares of land.

Another threat to nature is the deflections and failures of the earth's surface, which are formed over mine fields, oil and gas wells.

1.3.6 Energy production and the environment.

Throughout the existence of human civilization, manual labor was the main source of energy. Over time, it began to be supplemented by the energy of pets, water and wind (horse, water wheel, windmill, other simple mechanisms). At the beginning of XVIII century. people have invented and built many machines to improve working conditions. The main reason for the impossibility of their widespread use was the lack of driving force. The turning point came after the invention at the end of the XVIII century. a steam engine that has quickly found application in transport, wood processing, textile and other sectors of the economy. Initially, the main fuel for steam engines was firewood. After deforestation and due to the high energy demand, firewood was gradually replaced by coal. At the end of the XIX century. Coal has become mankind's main energy resource. Over time, coal was replaced by oil and its derivatives - gasoline, diesel and fuel oil. An internal combustion engine appeared. Petroleum products burn less waste than coal. The internal

combustion gasoline engine weighs much less and takes up less volume than a steam engine of the same power. The energy content of a unit of mass of gasoline is much higher than that of coal. Therefore, in the middle of XX century. The petroleum products used by internal combustion engines have become mankind's main energy resource. In the first half of XX century. humanity has begun to make heavy use of electricity. It should be noted that electricity should be considered as secondary energy. To get electricity, it is necessary to burn coal, oil, gas, nuclear fuel or use the energy of water movement, wind energy of other natural sources [47,60]. Electricity production is based on the phenomenon discovered by M. Faraday in 1831 and called electromagnetic induction. This phenomenon is as follows: alternating magnetic flux, penetrating a closed conductor, causes the appearance of; it electromotive force. An electric current is obtained by means of an electric generator, in which either the coil rotates in a magnetic field or the alternating magnetic field penetrates a stationary coil.

The main source of energy today is petroleum products. They account for 45% of total energy consumption. The share of natural gas is about 20%, coal - 22%. Nuclear fuel, hydropower and other energy resources account for the remaining 13%. Modern transport uses almost all 100% of liquid fuel. It is worth noting that today nuclear fuel, coal and hydropower should be used mainly for the production of electricity. Today, nuclear fuel is only suitable for electricity production and cannot be used in transportation, which is the main user of petroleum products. Nuclear fuel can replace petroleum products only in terms of the transition to electricity during heating of buildings, in heat treatment, and in electric transport [60,82].

For the last 50 years, people have had high hopes for nuclear power. It was assumed that nuclear power would allow it to produce electricity in large quantities, very cheaply and, most importantly, without a large amount of production waste. It was believed that this energy sector would have little or no environmental impact. In the 1960s, dozens of nuclear power plants began construction in many countries of the world. According to scientific experts, there could be several hundred in the year 2000. However, since 1975, the situation has changed dramatically. In many cases, the construction of the NPP has stopped. The reason was the anxiety of people and governments of several states that in the event of an accident, the situation at the NPP becomes unmanageable, it is very difficult to protect the environment and people from radiation, and it is almost impossible to evacuate the fast population. These fears became a reality after the Chernobyl accident (April 1986). Scientific and practical interest in the AU has changed beyond belief. Humanity has come into a contradiction: on the one hand, the need for energy is growing enormously, and on the other hand, there are practically no alternative energy sources for oil.

1.3.6 Energy production and the environment.

The mechanism of producing nuclear energy is fundamentally different from fuel combustion or chemical reactions. When fuel is burned, the atoms of the substances in such processes remain unchanged - they only regroup, forming different compounds. Atoms change in nuclear reactions. This happens by splitting the nucleus or fusion. In the process of splitting, the heavy nucleus of one element is divided into two lighter nuclei of other elements. In nuclear fusion, two light nuclei form one heavier nucleus of another element. In both cases, the total weight of the reaction products is less than that of the starting material. Thus, as a result of a nuclear reaction, the mass is converted into energy. The main process at modern nuclear power plants is a controlled process of splitting, in which energy is released continuously in the form of heat. The heat is used to heat water and produce steam, which drives conventional turbogenerators. Uranium atoms are usually used as a fuel. Disintegrating, in addition to energy, the U235 nucleus releases two or three neutrons that bombard other uranium atoms, so-called nuclear chain reaction begins. When the nucleus of a uranium or other element divides, in addition to the energy released, lighter atoms are formed - iodine, cesium, strontium, cobalt, and other elements, more of them. As a rule, they are all unstable isotopes. They move into a stable state over time, releasing elementary particles and high-energy radioactive radiation. Unstable isotopes are called radioactive substances. In addition to the products of fission of heavy nuclei, other substances inside and around the reactor, which absorbed the neutrons resulting from the chain reaction, may become unstable. All these direct and derivative products of the splitting of heavy atoms in a nuclear reactor are called radioactive waste from nuclear power plants. Radioactive radiation, when it enters a living organism, destroys molecules and atoms in the composition of matter cells. At high doses of irradiation, the division of cells is disrupted in almost all tissues, which means that the normal renewal of blood, skin, etc. will become impossible. Strong radioactive radiation completely destroys the cellular structure of a living organism and causes instantaneous death of living organisms. Radioactive radiation is extremely harmful and in small doses. It can destroy DNA molecules and affect the genetic material of the living organism. Separation of cells with such altered (mutant) DNA can become uncontrolled and, as a rule, lead to the formation of malignant tumors. Egg irradiation is accompanied by various defects in future generations. Therefore, the problem of radioactive waste disposal is very important for nuclear power. As elemental particles and radioactive energy are emitted, unstable isotopes go into a stable state and cease to be radioactive. This process is called radioactive decay. The rate of radioactive decay is such that half the mass of the isotope always decays over the same period of time. The next half break up the remaining half (1/4 of the initial amount), etc. Therefore, it is customary to speak of a half-life. Each radioactive isotope has its half-life - from fractions of

seconds to several thousand years. The radioisotope never decomposes by 100%. Its mass is only halved for each half-life. It is believed that after 10 half-lives, the radiation level can already be neglected.

The separation of uranium atoms leads to the formation of a very large mixture of radioactive isotopes. their half-lives range from a few days to many years. Particular attention should be paid to plutonium-239, with a half-life of 24,000 years. That is, in order to protect living organisms from the negative effects of radioactive waste, they must be stored in isolation for 240000 years (10 half-lives).

If you compare the performance of two power plants - nuclear and thermal power plants of the same capacity, such as 1000 MW, during the year, the following should be considered. Continuous operation of the TPP requires 3.5 million tonnes of coal. As a result of its combustion, more than 1 million tonnes of carbon dioxide, 400 thousand tonnes of sulfur compounds and 100 thousand tonnes of ash will be emitted. The plant requires 1.5 tonnes of enriched uranium, equivalent to 1000 tonnes of uranium ore. The radioactive waste will amount to about 2 tons.

In favor of a particular energy industry, the problem of the residues left after the fuel is spent, the possibility of their disposal and disposal should be taken into account first. In 2000, the power capacity of power plants reached almost 4 GW. Two-thirds of electricity is produced by thermal power plants that burn mineral resources.

In general, people today face a difficult dilemma. Each year, about 25 billion tonnes of carbon dioxide is emitted as a result of fuel combustion. About 200 million tonnes of sulfur gas are released from coal and fuel oil combustion alone. Almost 200 km3 of industrial waste is discharged into the rivers every year. At the same time, over the last 50 years, more minerals have been extracted from the bowels of the earth than in the entire history of civilization.

In 1985, 420 NPPs operated worldwide. About one and a half hundred were still under construction. The first place in absolute electrical capacity of the nuclear power plant was occupied by the United States, and in France the share of nuclear energy reached 75%. It planned to close all coal-fired thermal power plants by the year 2000.

It is worth pointing out as well. If all NPPs were replaced by coal power plants today, an additional 630 million tonnes of coal would have to be extracted and transported. An additional 2 billion tonnes of carbon dioxide, more than 30 million tonnes of nitrous oxide, 50 million tonnes of sulfur compounds, 4 million tonnes of fly ash would be added to the environment. On the other hand, the Chernobyl disaster caused radioactive contamination of almost 5 million hectares of the territory of Ukraine. 32 districts of six oblasts were exposed to radiation. About 200,000 people live

in the territory with a load of 5 curie and above. Light isotope iodine and cesium air currents have spread across the planet.

In general, all energy sources used by mankind today are divided into:

- Renewable - energy of the Sun, wind, sea tides, river hydropower, Earth's internal heat;
- non-renewable - fossil mineral fuel and nuclear energy.

The former do not affect the thermal balance of the Earth, because during their use, only one type of energy is transformed into another (say, the energy of the Sun is converted into electric, and the latter then into thermal). The use of the latter causes additional heating of the atmosphere and hydrosphere. It. in turn, leads to a rise in the level of water in the oceans, which affects the change in the ratio of land area and water mirror, changes the climate, the diversity of wildlife.

The point is that there is a thermal limit that humanity should not cross. According to experts, a dangerous limit will be reached when using non-renewable sources in an amount exceeding 0.1% of the total solar energy flow to the Earth. It is estimated that the solar energy flow is about 100 billion kW. On the basis of non-renewable energy sources, today energy is produced ten times less than the limit. If energy growth rates remain the same today, the thermal limit can be reached in the coming decades.

Energy calculations use a special unit - produced mass of fuel (conventional): 1 ton of conventional fuel is equivalent to 1 ton of coal, or 2.5 tonnes of coal, or 0.7 tonnes of oil, or 770-850 m3 of natural gas. The combustion heat of 1kg of conventional fuel is 29.3 GJ.

The forecast calculations also use the unit of Q, which equates to 36 billion tonnes of conventional fuel. The world's proven coal reserves are about 18 Q, oil is 3 Q, gas is 2 Q, uranium ores are 4 Q. It should be noted that, in addition to hydrocarbon fuels and uranium ores, there is another non-renewable source of energy in nature - heavy hydrogen, or deuterium - a potential fuel for the thermonuclear power plants of the future. Its reserves in the oceans are estimated to be 1900 Q. For comparison, let us say that renewable energies are estimated by: winds - 0.4 Q, tides and waves - 0.3 Q, Earth's internal heat - 0.2 Q, solar radiation - 2000 Q. Ukraine is provided with 95% of its own coal, 10% of its oil and 25% of its natural gas.

The above data indicate that if the mineral resources will continue to be used at today's rates, then all of its reserves will be used by mankind in the next 110-120 years.

So a person, in terms of preference for a particular source of electricity, has something, from an environmental point of view, to correlate and where to choose.

1.3.7 Problems of industrial and household waste

The development of human society is accompanied by the creation of large cities, the formation of agricultural and industrial centers and systems. In developed countries such as the USA, England, France, Germany and others, the urban population is already more than 70%. The process of urbanization leads to environmental degradation, deterioration of the physical environment of human habitation, reduction of land and forest area per capita, deterioration of air and water quality, destruction of natural landscapes and climate change. Particularly significant problems arise in large cities with the recycling of industrial and household waste. In recent years, a large group of chemicals and toxic substances, pesticides and toxic chemicals, wastes from the biological industry and radioactive materials have been added. It should be remembered that the emergence of new technologies, new industries, and in general the advances in scientific and technological progress is always accompanied by the emergence of environmental problems of a new type. Thus, the development of integrated instrumentation in microelectronics has led to the use of 54 new chemicals, many of which have high toxicity. There are significant amounts of electrolytes and chemical solutions that a person cannot recycle after use. Significant environmental security challenges arise when implementing biotechnology advances, especially in the context of genetic engineering. These problems are related to the effects of the entry into the environment of genetically modified living organisms, including microbes, which can multiply very quickly and in extremely large quantities.

The widespread use of electricity and electrical equipment in production, transportation, and everyday life creates the problem of oversaturation of the environment by electromagnetic fields. The latter, in addition to obstructing the operation of communication systems, television and radio, significantly affect human health and chemical and biological processes in nature. An important physical factor in the city is the industrial noise. Enterprises, transport, radio and television became the source of noise. On major urban highways, transport noise reaches 110 dB. Such noise acts very badly on the processes of regulation of physiological functions and, first of all, on the cardiovascular and nervous systems of the person.

Due to human activity, the impact on the biosphere has become irreversible. The numbers that express the total geological and geochemical activity of a person are astonishing in their size. When extracting minerals from the Earth's interior, 180 billion tons of rocks are already extracted, about 800 million tons of various metals are smelted, and nearly 650 million tons of mineral fertilizers and 3 million tons of chemical chemicals are introduced into the soil. About 3 billion tonnes of oil and petroleum products are burned to generate electricity.

1.3.7 Problems of industrial and household waste

Modern technology and technology can turn into a finished product only 8-10% of the raw materials produced, the remaining 90-92% goes to waste, polluting the aquatic ecosystems, reducing the area of fertile land. At the same time, the world's mineral resources are doubling every 15 years.

Every inhabitant of the planet accumulates from 300 to 500 kg of household waste per year. In one day, London dumped 16,000 tonnes of garbage in 2000, 24,000 tonnes in Tokyo, and 32,000 tonnes in New York. It must be stored, buried, or incinerated. Garbage collection requires large land areas, organization of permanent sanitary control, high transportation costs. All this in the complex creates considerable difficulties in the disposal of waste. The city, which numbers about 40,000 people, is required to allocate an area of 1 ha each year for the disposal of industrial and household waste, which is either mainly incinerated or buried. Unfortunately, human civilization has not yet developed any other approaches to this problem.

A significant problem for humans today is the mineral fertilizers and chemical chemicals used in agriculture. It is known that 40-60% of the chemical fertilizers are introduced into the soil, while the rest are washed into the rivers. At the same time, the use of chemical fertilizers from 1955 to 2000 has increased by 50 times. The use of pesticides, chemicals to control pests and weeds increases the productivity of the earth, but also affects the health of people. In developing countries, about 10 thousand people die from pesticide poisoning in the year, and about 0.5 million people suffer from various diseases.

For example, in a developed country like Germany, about 500 million tonnes of waste are generated annually, of which about 6 million tonnes are very harmful, and there are tens of thousands of industrial and household landfills, each covering an area of several hectares. At the same time, even in this highly sophisticated industrial sense, the state has only 65 waste incinerators operating in 2000, which annually process only about 10 million tonnes of waste. It has been estimated that 250-450 kg of slag, 40-70 kg of dust, 20-70 kg of absorption reaction products, 8-10 kg of salts are allocated per 1 ton of incinerated waste. The slag includes insoluble silicates - aluminum and iron oxides, carbonates, chlorides of alkali and alkaline earth metals, heavy metals. All this has to be stored in special places.

In the United States, the total annual amount of industrial solid waste is 1160 million tonnes, including very harmful 280 million tonnes, of which 10% is incinerated and 10% recycled. In addition, about 386,000 tonnes of municipal solid waste is collected every day. The total volume of annual chemical waste is almost 100 million m3, and radioactive waste is generated up to 6

thousand tons per year. Such a large mass of waste is stored in 75,000 industrial burial grounds, 180,000 surface sedimentation tanks and about 200 special structures.

Japan is particularly concerned with the issue of waste, in which all industrial waste is divided into 22 species, including 12 very harmful and 8 extremely harmful - mercury, cadmium, lead and other chemical and poisonous compounds. In 2000, only 362 million tonnes of waste (out of a total of 1300 million tonnes) was processed in Japan [83].

102 million tons of highly toxic waste are produced annually in Ukraine. Different types of storage have accumulated 22 billion tonnes of this waste, of which 350,000 tonnes have been stored in deep storage. Part of the repositories is located in enterprises, the rest is in unpowered landfills, the rest in random places and unauthorized burial grounds. Ukraine does not have environmentally friendly technologies for processing and disposal of highly toxic waste. There is no burial ground for the disposal of radioactive waste in the territory of Ukraine.

Radioactive waste should be included in a separate group. Modern nuclear power plants (NPPs) and nuclear boilers use thermal neutron reactors. As a rule, the enriched uranium is U235. In normal operation, a nuclear reactor produces a significant amount of radioactive substances in the nuclear fuel cycle - more than five hundred names of radioactive isotopes. Of the fission products, inert radioactive gases (krypton and xenon isotopes), iodine isotopes (primarily iodine-131), strontium (strontium-89 and strontium-90) and cesium (cesium-134 and cesium-137). Among the radionuclides formed in the reactor and in its coolants, long-lived radioactive gases - hydrogen-3, carbon-14, krypton-85, iodine-129 - are of particular concern. With the significant growth of nuclear power, their concentration in the biosphere will increase dramatically. Particularly harmful are the high concentrations of carbon-14, which accumulates in all organs and tissues of the human body and affects genetically important structures. The half-life of this radionuclide is about 6 thousand years. In addition, nuclear energy requires a large amount of natural resources, especially water, and produces a significant amount of waste.

NPP radioactive waste is divided into three groups - gaseous, liquid and solid. Only gaseous and partially liquid wastes are released into the environment (after a complex treatment system). Solid waste is then stored at the NPP and then stored must be sent for special disposal. The qualitative and quantitative composition of radioactive waste significantly depends on the type of reactor, the state of the main equipment, the operating conditions, the quality of nuclear fuel and the characteristics of the waste treatment systems.

Accidents at the Trimain Island nuclear power plant (USA) in 1979, and especially at the Chernobyl nuclear power plant (USSR) in 1986, dispelled the myth of "absolute harmlessness" of

nuclear energy facilities. As a result of the accident at the fourth reactor of the Chornobyl NPP, which had a capacity of 1 million kW, killed 31 people, irradiated with various dangerous doses of 24200 people, relocated to other areas 116 thousand people, withdrew from agricultural use about 300 thousand hectares land. All fission products formed in the reactor core were discharged into the atmosphere [63,71].

1.3.8 The problems of the ozone layer

An important component of the atmosphere is the ozone sphere, which is composed of O3 molecules - ozone. The bulk of ozone is at an altitude of 10 to 50 km, with a maximum of 18-25 km and is estimated at 3.3 trillion. tons In the ozone layer, ozone is in a rarefied state. If all the ozone was collected at a pressure of 1 atmosphere and a temperature of 20 ° C, the thickness of this layer would be 2.5-3.0 mm. The ozone sphere affects the climate and protects all living things on Earth from the sun's and UV's radiation in general.

Ozone gas is very volatile. The process of the destruction and renewal of ozone in the atmosphere is ongoing. In one second, about 100 tons of ozone is created and destroyed in the Earth's atmosphere. The average life of O3 molecules is about one year, but their conditions of existence at different heights are different. In the upper atmosphere, the lifetime of ozone molecules tens of hours, at an altitude of 18-26 km - increases dramatically. The major destruction of O3 molecules occurs near the Earth's surface, where their life spans are reduced to several days. The process of ozone formation mainly occurs in the upper atmosphere of oxygen, nitrogen dioxide by the direct action of ultraviolet radiation of the sun and other atmospheric gases.

Ozone plays an extremely important role in the processes of radiation energy transfer. The ozone layer almost completely absorbs and scatters the ultraviolet radiation of the Sun, especially in the spectral range of 0.20 -0.35 μm, which is approximately 1.5% of the total energy of our light in the Earth's atmosphere. The ozone layer absorbs and scatters long-wave infrared radiation in the region of 9.0-10.0 μm. These processes determine changes in the temperature of the atmosphere at an altitude of 30-60 km, which in turn, through complex mechanisms of interaction forms the circulation of the atmosphere, and therefore the peculiarities of climate on our planet [4,9].

In the context of the formation and development of life on Earth under the protection of the ozone layer from the action of high-energy ultraviolet radiation, biological processes occurring on the planet are extremely sensitive to this action. Under the action of high-energy ultraviolet, biological effects arise and flow, causing changes at the molecular, cellular levels in humans,

animals, plants, microorganisms in ecosystems. As the dose of ultraviolet radiation increases, burns occur in humans, which can lead to skin cancer. This is explained by the high sensitivity of nucleic acids to ultraviolet radiation, which at certain doses of radiation begin to destroy, which leads to the emergence of mutation processes and cell death.

It is shown that a 50% reduction in the total ozone content in the atmosphere leads to a significant increase in the intensity of ultraviolet radiation, which significantly affects the development of all living things.

The total ozone balance in the stratosphere is governed by a complex complex of physicochemical processes. Nitrogen oxides, heavy metals (copper, iron, manganese), inert gases (fluorine, chlorine, bromine) play an active role in the processes of ozone formation and destruction. About 70% of the ozone is destroyed by the nitrogen cycle, 17% by oxygen, 10% by hydrogen, about 2% by chlorine. It is important to note that in this process nitrogen, chlorine, oxygen, and hydrogen play the role of catalysts, ie they do not change their concentration. Therefore, getting into the atmosphere, these substances significantly and for a long time affect the processes of formation and destruction of the ozone layer.

It is worth noting the chemical activity of these elements in relation to

ozone molecules. One chlorine atom can destroy 100,000 ozone molecules.

Freons that have fallen into the atmosphere can persist in it in a hundred years.

Throughout their existence, they play the role of a hub

heat, and 20,000 times more efficient than carbon dioxide -

product of combustion of fuel. That is, in addition to the destruction of the ozone layer, the freons in the atmosphere contribute to the appearance of the greenhouse effect.

In recent decades, humankind has begun to use large quantities of chlorofluoromethane (freons) as solvents for paints and varnishes as a component of aerosols. This led to the appearance of hundreds of millions of tons of freons in the atmosphere. Lifting up, the chlorofluoromethane under the action of radiation decomposes, releasing chlorine and fluorine, which are involved in the destruction of ozone. The same effects are caused by the overuse of nitrogen fertilizers in agriculture, which increase the content of nitrogen oxides in the atmosphere. Atomic explosions in the atmosphere, emissions from combustion products, and the launch of powerful spacecraft also contribute to the process of ozone depletion. Scientific observations of the atmosphere have shown that the amount of ozone over Antarctica has begun to decline dramatically since the late 1970s. In 1987, a "window" appeared in the ozone layer, reaching 500 km in diameter. The ozone level in this hole in the month of October, when spring begins in the South Pole, drops to a minimum. At the

end of November, when the polar night ends, the hole disappears. That is to say is still going on for one month. However, the appearance of a hole in the ozone layer over Antarctica affects the climate and weather across the globe. The emergence of a hole in populated America or Europe can have catastrophic consequences for humanity as a whole.

The problem of maintaining the ozone layer has gradually shifted from a purely scientific field to politics and economics. Humanity had to ban the release of all sorts of Freon-based aerosols, to limit the start-ups and mar-flights of supersonic Concord and supersonic space shuttle Shuttle (US) and Energy (Russia).

In March 1989, a conference called "Save the Ozone Layer" was held at the London Science Center. The very fact that it was attended by delegations from 120 countries of the world speaks of an extreme threat to humanity. At the conference, it was emphasized that ozone depletion is the major contributor to the advanced nations, so they must provide funding and development for new technologies to protect the ozone layer.

In March 1994, the European Ozone Layer Conference was held in Prague. From a report by representatives of the Czech Republic (J. Peterlich and F. Welger), it became known that according to 1992, the ozone hole also appeared over the Northern Hemisphere of the planet. By the intensity of the ozone depletion, the processes here develop in the same way as it was over the Southern Hemisphere (in Antarctica). Speakers believe that the ozone layer is not better than the Central and Eastern European countries.

The conference established the "Ozone Union" for the countries of Central and Eastern Europe. its purpose is to exchange information on the protection of the ozone layer in Europe and in each country.

1.4 State of the environment and human health

Human health is a category not only social but also ecological and economic, since it directly affects the efficiency of the use of productive force, determines the productivity and ultimately the standard of living. The level of health of the population is directly related to the economic and economic situation in the country. The state of health of the society as a whole is greatly influenced by nerve congestion, the growth of stressful situations, information overload, and especially the worsening of the environmental situation. There is a direct link between pollution, poverty, hunger and all kinds of diseases. Of the 6.5 billion people living on Earth today, 1.2 billion

are illiterate, about 400 million are unable to study even in elementary school, 2 billion are living in unsuitable rooms - without electricity , sewage, water supply [27,38]. About 1.5 billion people are in dire need - they do not eat every day, and almost 1 million adults die directly from starvation a year. In 2000, 14 million children died under the age of 5. At the same time, the population increases annually by 2.1%, and in some countries the increase reaches a value of 3-4% (Colombia, Venezuela, Costa Rica, South and Southeast Asia). It is considered that in order to live and work normally, one must use at least 103 kJ of energy per day. Much of this need is obtained through the use of various proteins. Today, almost half of the world's population is experiencing chronic protein starvation. Especially it is felt by the population of Asia, Africa, South America. 70% of the world's population lives here, and only 43% of the world's food is produced. The main source of food for mankind is arable land. Today they cover about 11% of the land and together with pastures and hayfields (23%) supply us with more than 90% of the food. Considering that 30% of land is occupied by mountains and forests, 40% by glaciers, deserts and swamps, it is practically impossible to increase the size of arable land.

Fracture in providing the Earth's population with food

can only be achieved if there is a sharp, increased return on

units of fertile land area. Throughout its existence, humanity has worked on this problem. The most significant results were achieved

in recent centuries. Thus, in the XVIII century. average grain yield was about 6-8 c / ha, in the XIX century. this value was brought to 20-22 c / ha,

at the end of XX century. each hectare gives about 40-42 cg of grain. That is, for the last

300 years the return on a unit of arable land has increased 6-7 times.

This was achieved mainly through the mechanization and chemisation of agricultural production.

Annual cereals harvest worldwide is 2.2-2.5 billion tonnes. The major part of it is made up of three crops - wheat, rice and maize.

Annual meat production is conditioned by livestock and amounts to

about 550 million tons per year. The cattle population is about

1.5 billion head, pigs - 950 million head, sheep - 1.3 billion head. Further growth in the livestock population is constrained by the development of fodder

bases.

Until recently, in the solution of the food problem, great hopes were placed on the oceans. The large size of the area and the very large volumes of water created a misconception about

virtually inexhaustible ocean bioresources. Recent studies have shown that this is far from the case [13,20]. The bioresources of the seas and oceans are large, but not infinite and require protective measures. It was found that the biomass of the oceans is less than the biomass of dry species by almost 700 times. The productivity of the average land area unit is also many times higher than in the ocean. Today, the oceans occupy 71.8% of the Earth's surface and provide about 2% of the total amount of food. So today and in the near future, humanity must count on the production of food in the first place, on land resources [4,26].

The use of mineral fertilizers is of great importance for the production of the required amount of food, for the development of agriculture. Mineral fertilizer doses should be extremely optimized. Small doses do not produce the necessary yields, and when making excessively high doses, pesticidal overload occurs and, over time, soil, soil and wastewater, air, and the biosphere become contaminated. Increased concentrations of fertilizers in the soil lead to excess of various elements and their compounds in different crops, which affects the content of carcinogenic compounds and substances in the human body.

Nitrogen fertilizers lead to the formation and accumulation of nitrates, which in the human body under the action of acids and alkalis are converted into nitrites (salts of nitric acid) and are involved in the formation of nitrosoamines (carcinogenic compounds). These compounds interact with blood hemoglobin, converting divalent iron into trivalent methemoglobin, which decreases oxygen transfer and impairs normal breathing.

It is estimated that 2.2 million tons of technogenic nitrates annually fall on the Ukrainian soil, which averages 20 kg per hectare of territory. Half of this poison is supplied by internal combustion engines, the rest by thermal power plants and industrial enterprises. 60-100 kg of nitrates per year per hectare of soil per hectare of intensive road traffic. This is because one car emits 50-70 kg of nitrogen oxides per year, which react with moist air and precipitate in the form of nitrates. Power plants and industrial enterprises form at least another 500,000 tonnes of nitrates. With nitrogen fertilizers, in the form of ammonium nitrate, about 2.2 million tons of nitrates are scattered annually in the fields of our country. Therefore, as a whole, 24-26 kg of nitrates are scattered on a hectare of Ukrainian land, and 85-87 kg on a hectare of arable land. Therefore, plant products grown in such fields contain nitrates ten times more than the limit. The State Sanitary Service has shown that in recent years the content of nitrates has increased in watermelons and melons 3 times, potatoes - 2.2 times.

The polluted waters cause great harm to human health. The process of water pollution has become global. Virtually all open water bodies (rivers, lakes, artificial reservoirs) that are sources of

water supply to cities contaminated by industrial and agricultural wastes, so that this already borders on their inability to be used. Pesticides, toxic substances, soluble gases, and a large number of microorganisms are found in large quantities of water used by humans today. Particularly great danger today for reservoirs is economic and household sewage wastewater of settlements. These effluents carry large quantities of harmful inorganic, organic, biological and other contaminants. In the absence of a proper treatment system, contaminated water may pose an epidemiological threat. According to the World Health Organization, difficulties with drinking water

today there are 2 billion people. Up to 600 are registered each year

mill. cases of infectious diseases caused by poor water

[26].

The process of urbanization, on the one hand, improves the living conditions of the population, and on the other - leads to the displacement of natural systems by artificial, pollutes the environment, increases the chemical, physical and mental components of human stress. The big city changes all the components of the environment - the atmosphere, soil, flora, terrain, groundwater and even affects the climate. Electric, magnetic and other fields of the Earth have been changed in cities. The impact of a large city, home to more than a million people, extends to a depth of up to 4 km. These cities receive 15% less solar radiation, 10% more precipitation, 30% more fog in summer and 100% in winter. In large cities, there are significant problems with water: it is lacking, water quality does not meet the requirements, there are problems with treatment plants.

As a result, the incidence of many diseases, not just infectious ones, is much higher in large cities. It was found that the level of infectious diseases of the urban population is higher, twice higher than that of the rural population [59].

Greater contact with people in cities, on the one hand, is a positive factor because it produces considerable mental training, maintains a professional and creative personality tone. On the other hand, when processing a large amount of information, there may be disorders of the nervous system, breakdowns, neuroses, and neurotic conditions.

The human body in the city receives a great negative load from the effects of industrial noise. The main sources of noise in the city - industrial enterprises, motor transport, other industries. At a noise level exceeding 80-100 dB, the average age of life decreases by 8 - 12 years. High noise is the cause of nervous breakdowns, neuroses, ulcers, cardiovascular system disorders, it reduces labor productivity by 15-20% [89].

The share of big cities on the planet has increased from 2 to 30% in the last hundred years, and over the last 50 years, the growth of large cities has been characterized by an explosion. In

1700, there were 31 cities in the world with a population of more than 100 thousand people. In 1800 there were no cities with a population of more than 1 million, in 1985, according to 00H, there were 270, and in 2000 - 400 millionaires.

According to the World Health Organization, up to 20% of adults in major cities in the world suffer from hypertension. Cardiovascular disease in millionaire cities accounts for about 50% of all deaths. Experts note that mortality in large cities is 30% higher than in rural areas [27,29].

2 ECONOMY AND ECOLOGY IN THE CONTEXT OF SOCIAL DEVELOPMENT

If, in adulthood, a young man seeks to become a full-fledged member of the post-industrial community, he is forced to acquire modern economic knowledge and environmental culture, to learn to think in economic and environmental categories in all aspects of his life-process.

In Ukraine, where a market economy is just emerging, eco-economic education has its own specificity. Our country, unlike economically developed countries with a stable market economy, lacks traditions, market moral factors, business activity.

Ecological and economic education and training should be aimed at preparing a person for science-based economic action, the formation of an effective host, who thinks in the categories of economic science, reflecting new processes and phenomena in the economy, and is able to use them effectively in practice [21-23] .

2.1 Forms of organization of social production and ecological-economic relationships

Analysis of the development of society shows that humanity throughout its history has known two forms of organization of production - natural and commodity. The former prevailed in all pre-capitalist (even-market) formations. The second, which began in the period of development of the primitive system, has survived to this day and is the basis for the development of modern industrialized countries.

Historically, natural production was the first to emerge. Natural production is a type of economy in which the products of labor are intended to meet the producers' own needs, the consumption of the average farms where they are produced. In its purest form, natural production existed in the primitive community when people did not yet know the social division of labor. Natural production prevailed in the patriarchal peasant community, in medieval feudal estates. Produced products of labor in the form of specific benefits - food, clothing, shoes, housing, tools, satisfy certain needs, and become natural forms of wealth.

In the natural economy there was a closed cycle of the manufactured product, which, as a rule, did not go beyond their borders. Each business unit was completely separate from the others in both production and consumption. The level of consumption of economic entities depended solely on the level of production.

Natural production has the following basic features:

- Versatility of work. The activities of the entity in the natural form of production, aimed at meeting their own needs, as a rule, with the same set of types of work. True, within the subsistence economy, work is shared between individuals and groups.

- Closed production. Each farm relies on its own production resources and provides itself with everything necessary. In such an economy any work is performed - from extraction of raw materials to production of finished products and their consumption.

Direct economic links between production and consumption. Direct natural connections lead to the direct use of the manufactured product by the producers themselves, which is the defining feature of the economy. Such relationships express the way in which the product is produced by the following scheme: production - distribution - consumption. Natural production was the predominant form of pre-capitalist epoch-making. And today, to some extent, the elements of subsistence farming take place in many countries, including ours (for example, production in gardens). However, natural production is not only a primitive and conservative form of production, but also inefficient, inefficient. He was replaced by commodity production.

Commodity production is a type of economy in which the products of labor are produced by separate economic entities to satisfy not their own but public needs by buying and selling these products that become commodities.

The material basis for the emergence of commodity production is the social division of labor, which means the specialization of producers in the manufacture of certain types of products or in certain production activities. It is the social division of labor that determines the objective necessity and possibility of regular exchange of products.

Another prerequisite for the formation of commodity production is the economic isolation of producers, which is the latter's ownership of the products of labor that become a commodity. You can only exchange what belongs to the manufacturer, that is, his property.

Commodity production, which emerged as the opposite of subsistence farming seven to eight thousand years ago, remains and is effective today. It has the following defining features: social division of labor; full socio-economic separation of producers; economic links between separated producers that occur through exchange; private ownership of labor results.

The product of labor takes the form of a commodity that has two properties: 1) the ability to meet a specific human need; 2) the ability to exchange for other goods through sales.

A commodity is a product of labor that satisfies a particular human need and is made for the purpose of exchange.

The system of factors of production, which ensures the transformation of the substances of nature in accordance with the needs of people, creates material and spiritual goods, which are the productive forces of society. This system includes [11]:

- employees;
- tools (tools, mechanisms, machines, engines, apparatus, various devices, etc.);
- objects of labor (land, raw materials, materials, minerals, etc.);
- forms and methods of production organization;
- information (Fig. 2.1).

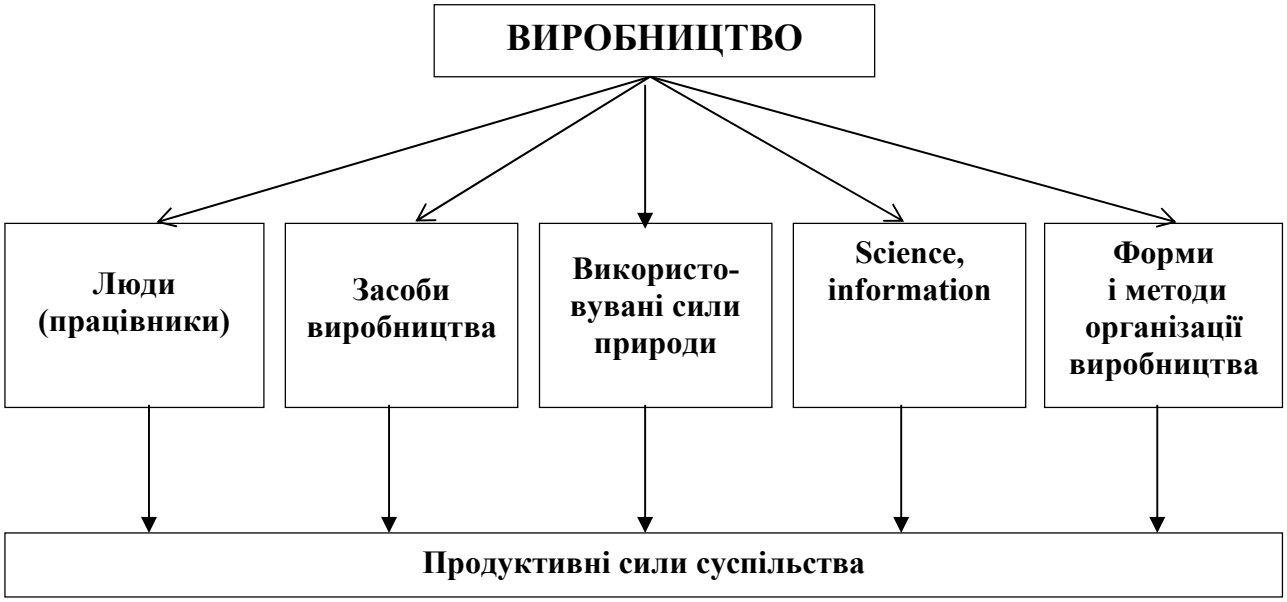

Fig. 2.1. The main components of the productive forces of society

Elements of the production process are labor, objects of labor and means of labor. Together, the means of labor and the objects of labor constitute the means of production (Fig. 2.2).

The emergence of commodity production, as we have already found out. there are two prerequisites.

The first is the exchange of goods based on equivalence. For example, we can exchange one general notebook for four pencils only when the production of one common notebook takes as much work as four pencils. That is, they have the same value. Equivalent exchange is possible in the presence of freedom of choice, which is only possible in a competitive environment [11].

Fig. 2.2. The main elements of the process of social production

The second is the economic isolation of producers, which involves the independent choice of activities of economic entities, the independent (free) formation of the program of activity, etc. And this is nothing but entrepreneurial activity.

Thus, entrepreneurship is an integral feature of commodity production. Without the freedom of economic activity, ie entrepreneurship, commodity production does not exist. In turn, entrepreneurial activity is impossible without the presence of commodity production, which for entrepreneurship is the material basis, base, soil on which only entrepreneurial relations can develop.

Signs of entrepreneurial activity are fully manifested in the modern market economy, where they have certain features due to commodity relations.

Commodity organization of production is a driving force for the development of productive forces of society, improving the efficiency of production, as it leads to a further deepening of social division, specialization of production and as a result - to an increase in the number of products produced, ie labor productivity. According to historical experience, the movement of an optimally organized economic system, oriented on the criteria of efficiency and ability to regulate itself, takes place on the basis of market relations. The market, first of all. acts as an exchange of goods organized under the laws of the movement of commodity relations. Market entities are individuals

and legal entities engaged in economic relations.The market objects are products, technologies, information and services that are in strong demand and are constantly entering the market.

2.2 Greening the economy

Today, humanity is beginning to realize that any economic decision to develop social production must take into account its environmental consequences.

The connection between ecology and economics is already laid down in these terms. The word "ecology" is derived from the Greek "oikos" - home and "logos" - science. The word "economics" also has a Greek origin and means the art of housekeeping. Thus, the study of our Suburban House encompasses the study of all its organisms and all the processes that make this house habitable [20,50].

Often, we are more aware of and appreciate the economic benefits that society receives, without thinking that all humanity receives from nature itself. Only recently, when ecological crises are increasingly occurring in different corners of the Earth, have we not only begun to rejoice in new technological advances, but also to realize and count what they have done to humanity. Even small changes in nature can have a very negative impact on a person's economic activity. The inseparable link between environmental and economic and political aspects of society is well characterized by such a well-known historical event. In the XVIII century. in France, massive deforestation was carried out, causing heavy flooding and soil erosion, which in turn led to popular uprisings and then to the end of King Louis-Philippe's reign. This example, of course, is not alone. Today, nature is no longer able to absorb and counteract the consequences of unsustainable management.

The basis of increasing people's material wealth is social production. However, with the continuous growth of production capacities, society began to face an exacerbation of the ecological situation - depletion of natural resources, pollution of the environment, deterioration of the physical and moral condition of people, loss of communication between man and nature. These losses cannot be offset by an increase in the consumption of material goods produced by production.

Society has always depended on natural resources and the state of the biosphere, but this dependence has not been taken into account in economic systems. The ecological crisis is the result of traditional economic policy, which was aimed primarily at obtaining today's profits, reducing the cost of production due to environmental pollution. This is due to the fact that civilization has long

evolved through the use of excess natural resources without global anthropogenic disturbances of the biosphere. That is why until recently there has been no economic assessment of clean air, water, wild animals, landscapes. This environmental awareness has contributed to the plundering of natural resources and the destruction of the environment.

Economists are not obliged to develop new technologies, but they can calculate and justify the impact of certain technologies on the environmental impact of production, in particular to change the practice of calculating the cost of projects and the potential profits, to set maximum permissible environmental loads, wider use Keep in mind the polluter pays principle.

Improving the environmental situation requires a structural restructuring of the economy. In industry, this means a reduction in the growth rate of the extractive industries and a redistribution of released funds for the technical and ecological and economic improvement of the waste processing and utilization industries. In agriculture, the intensification of production must be carried out through the rationalization of land use, land reclamation, and the use of advanced biotechnologies. Greening eco-economics involves overcoming established ideas about production processes in the system of resources - technology and, therefore, should be based on:

- formation of legal and organizational conditions for rational use of nature;
- creation of scientific and technical potential for the reorientation of eco-nomics to resource-saving technologies;
- change of the main directions of social production, culture of consumption;
- creation of closed production cycles, giving priority to waste-free technologies;
- streamlining the production accounting system for natural resources.

In a market economy, the environment remains a "free commodity". As long as the costs of raw materials and production do not include the cost of use or pollution of air, water and land, they will continue to be irrationally exploited and the level of environmental pollution will increase.

At the 1992 UN Conference on Environment and Development in Rio de Janeiro, the attention of the world community was drawn to the need to formulate national strategies for the transition to sustainable development that create the preconditions for balancing the needs of society and the opportunities of nature agreed consideration of the problems of the state of the environment and socio-economic development. These problems are especially important for Ukraine, which is currently a transition country and is experiencing a period of ecological and economic crisis.

At present, the effectiveness of the state's environmental and economic policy can be based on three basic principles:

- minimization of anthropogenic transformations;
- stages of elimination of their negative consequences;
- a selective approach to environmental measures to increase their effectiveness.

2.3 Human impact on nature at different stages economic development

Human interaction with the environment occurs in different forms and with varying intensity at different stages of the historical development of mankind. Historically, there are several stages of human impact on the environment:

- human impact on the environment as a normal species;
- changing the environment through processes such as intensive hunting, grazing;
- intensification of the impact on nature by plowing large areas and deforestation to a large extent;
- a global change in all environmental components of the biosphere as a whole.

At the first stage of the development of human society, the attitude to nature was simple and primitive - taking everything you needed for yourself without thinking about the consequences. The ancient tribes were harvesting fruits and hunting wild beasts. Primitive tools made it possible to meet the minimum needs of each family member. At that time, the metabolism between man and nature was approaching equilibrium because man was part of nature's system as its biological component. However, already in the epoch of primitive community, the impact of man on nature became more noticeable. She mastered the fire, learned how to build a home, make clothes, use more sophisticated tools. With sharp wooden spears, bows, arrows, paddocks, nets, she improved hunting and fishing, which led to a rapid decline in the size of large animals, many of which were sedentary and slow to breed (cave bears, giant deer, northern elephants, etc.).

With the advent of bows and arrows increased the volume of hunting, and therefore, the impact of humans on the environment. According to some researchers, Paleolithic humans have accelerated the extinction of mammoths, woolly rhinos, cave hyenas, giant deer and many other large animals.

The new Stone Age was marked by the domestication of animals and the development of agriculture. With the development of animal husbandry and agriculture, the impact of man on nature has increased even more. The high density of livestock in the pastures has led to the destruction of vegetation and the migration of wild animals from their habitats. It is suggested that

the emergence of deserts in Central and Central Asia in Africa is the result of the overgrazing of livestock and the destruction of the turf of the dry steppes [10].

Settled life contributed to the development of agriculture. Although soil cultivation tools were primitive, the environment had undergone significant changes due to its use. Significantly influenced the vegetation of the slash-and-fire system of agriculture. Natural complexes were destroyed in vast areas. Under this system, the land was "involved" 10-15 times more than under crops. The forests were burned and for hunting purposes - in this way the animals were driven out. All this caused depletion of vegetation, increased soil erosion, decreased groundwater levels and, eventually, desertification. Some scientists believe that the inappropriate use of fire by our distant ancestors led to the emergence of the Sahara Desert.

However, in general, there was still a certain balance in the use of natural resources during the communal system.

In the slave-owning society, the environmental impact of man has greatly deepened. With the labors of slaves, irrigation facilities were erected, forests were burned, and pastures and acreage were expanded.

In the era of feudalism, agriculture was especially developed due to the destruction of forests in large areas. Forests were also destroyed for timber needs for the sailing fleet. For example, it took 4,000 oaks to create one ship capable of crossing the ocean. Only about half a million centuries of oaks have been used to create the Spanish Invincible Armada. The first affected Western Europe - the former wooded continent was transformed into almost treeless. Over time, the process of deforestation became widespread.

In the Middle Ages the area of forests and in the Carpathian region significantly decreased. According to literary sources, at the end of the first millennium AD, almost all the lowlands and foothills of present-day Transcarpathia, Pre-Carpathian and Bukovina were covered with forests and meadows. At the beginning of the XIV century. the area of arable land has grown year by year, and forests are becoming smaller.

Changing landscapes has certainly dramatically altered the animal world. The number of many animals and birds has decreased significantly, and some species have completely disappeared. Back in the era of feudalism, many laws were issued to preserve animals. The now-defunct tour and the tarp were taken under guard.

With the development of industry, human impact on the environment has reached its maximum. It was during this period that the cult of nature was replaced by the cult of technology. The development of industry forced the use of more and more natural resources. In addition to

expanding the use of land, forests, animals, intensive exploitation of subsoil, water resources and more began. According to the calculations of Academician OE Fersman, only during the XIX century. more than 54 thousand tons of non-ferrous and precious metals were extracted from the Earth's surface, and coal only in the second half of the nineteenth century. - 15 billion tons [].

Due to the depletion of natural resources and the development of industry, a new problem has arisen - pollution, which, in turn, has not only adversely affected soil fertility, plant and animal productivity, but also created a significant threat to human health.

Generalization of all present types of human impact on the environment makes it possible to distinguish its four main forms:

- change in the structure of the earth's surface (land plowing, deforestation, reclamation, creation of artificial lakes, seas, etc.);

- change of the biosphere and its constituents (extraction of minerals, release of production waste into the atmosphere and the oceans, etc.);

- change of energy balance of the globe;

- changing the totality of living creatures by destroying certain species, creating new species of animal and plant species, relocating animals and plants to new places.

At a time of rapid growth in all types of production, human impact on the environment has gained the greatest strength and has a global character today.

In particular, the greatest changes in the nature of the Carpathians occurred in the XVIII-XIX centuries, when the systematic exploitation of natural resources began. The wood-processing industry, which developed in the second half of the 19th century, was depleting forests. Much of the wood was fused by the Tisza, the Dniester. By the beginning of XX century. oak forests have almost disappeared in 90% of their area. In the mountainous area intensive exploitation of forests led to the fact that the primary coniferous-deciduous species on the northern slopes and deciduous - in the south began from the end of the XVIII century. to yield to spruce and other monocultures. This has influenced the existence of many species of animals. In particular, the felling of wild fruit trees for the furniture industry has led to a deterioration in the forage value of the forest for the animals that feed on the fruit.

For the past 12 centuries, at least 8 species of large animals and 12 species of birds have been completely destroyed in the Carpathians. Some species, due to the limitation of the arena of life and intensive industry, occupy 2-10 times smaller area than 100-200 years ago.

Even in prehistoric times, the reindeer were found on the northern slopes of the Carpathians. Tarpans occurred in the lowlands of Transcarpathia until the IX-XI centuries. In Bukovina - up to

the XV century. In the documents of HU1 Art. another mention is made of a tour that has rarely been met in the Uzh Valley. Now it is reminiscent of the names of villages, years, mountains.

2.4 Ecological contradictions between the biosphere and technosphere

The deterioration of most ecosystems of the biosphere, a significant decrease in bioproductivity and biodiversity, catastrophic depletion of soils and mineral resources, unprecedented pollution of the Earth's surface, hydrospheres and atmospheres are associated, first and foremost, with the intense growth of the population over the last 50 years. It was the need to meet the increasing needs of human society that led to the enormous expansion of economic activity, changes in the proportions of the world economy, production facilities, technology and technologies, product range, production and personal consumption. The production and consumption models that have developed in the world have ceased to meet the conditions of normal coexistence of man and nature [20-22].

The development of a global ecological and closely related socio-economic crisis, which today threaten the existence of our civilization, has led, figuratively speaking, two global factors - demographic, that is, a sharp increase in the population of the Earth over the last century, and industrial-energy, and also caused by catastrophic resource absorption and production.

Let us consider these and other factors in more detail and try to identify the links between them, as this will help to understand how human and nature interdependent, what the human community must be about the environment, how energy and matter production and consumption should be regulated .

Demographic factor. However, it took a few million years for the population of the planet to reach 1 billion in 1850. However, the pace began to rise sharply: the next billion had already been added in 80 years, the third in 30 years, the fourth in 15 and the fifth in just 12 years!

According to experts, the uncontrolled growth of the planet's population and the continuous growth of one person's needs for raw materials and energy are the main reasons for the development of the global environmental crisis, which has led to other crises (depletion of resources, pollution of geospheres, negative climate change, etc.).

In 1750, the Earth's population was about 500 million; over the next 100 years it doubled, doubled again in the next 80 years, reached 4 billion people in 1975, and exceeded 6.5 billion in 2005. Every minute, the population of our planet increases by an average of 172 people. This means that about 1.7 million people are added to the Earth's population every week - as many now live in cities of Ukraine such as Zaporozhye, Zhytomyr and Vinnytsia combined.

It is projected that in the near future the population will increase by about three persons every second, ie by 100-110 million a year, already at the end of the first half of the 21st century. will reach about 10 billion population growth will come from developing countries (88%). Demographic scientists believe that by 2100 Earth's population should stabilize somewhere at the level of 12-13 billion people.

Special studies show that to maintain the normal existence of so many humans, the Earth's natural resources and capabilities of the biosphere will be absolutely insufficient. Even if the population is 7-8 billion people, there will be mass extinctions of people on the planet from hunger, epidemics, diseases, wars will start because of the lack of fresh water.

In addition, population growth is accompanied by anomalous territorial distribution due to over-urbanization and the formation of metropolitan areas with 15-25 million inhabitants. According to 00N experts, 50 of the world's 60 giant cities will be located in developing countries at the beginning of the third millennium. According to experts, the largest cities will be Mexico City, Tokyo, São Paulo, Calcutta and Bombay. About a third of humanity today lives in cities with a population of 1 million or more. In developing countries, about 80 million people move to cities each year. It is the gigantic cities that have become the largest and most dangerous environmental pollutants and destroyers of nature, its "cancerous tumors". They are characterized by the re-pollution and activation of the degradation of nature in large adjacent areas; it also complicates the control and management of the social and economic spheres, the environment, transport, water supply, housing, security, etc.

Demographers estimate that by 2050 about 50% of the world's population will live in cities.

The well-being of society depends directly on the population, the level of development of the economy and the state of the environment. All these factors are closely linked, and changing one of them cannot but affect the other. It is difficult to determine exactly what a person's well-being is, but the most important of its components is to consider health and well-being. It is an unforgivable fact for everyone that our well-being (and therefore health) depends entirely on the state of the natural environment in which we live, on the quality of the air, water and food we consume, on nature's ability to self-purify and self-regenerate. the guarantee of our well-being and the well-being of our descendants is the preservation of a clean environment, a normally functioning biosphere.

Industrial and energy factor. Scientists estimate that the modern biosphere of the Earth is able to support the normal existence and development of no more than 4-5 billion people, in addition, under conditions of optimal distribution of national income, mutual assistance, support and understanding of all nations, their high ecological and economic culture, effective use of human

intelligence to ensure the well-being of all the people of the planet, global peace, sustainable use of nature and nature. Even with the stabilization of energy production at the level of the thermal barrier (100 billion kW), the population should not exceed 10 billion people (the amount of energy required per capita is about 10 kWh).

In recent decades, these conditions are not observed, causing the development of the global energy and environmental crisis, the emergence of new diseases (AIDS, Ebola fever, new varieties of influenza, etc.), the increase of epidemics of various diseases, the outbreak of wars, the emergence of catastrophic events of large number of natural disasters. More and more regions of the planet are becoming areas of environmental disaster: Afghanistan, Iraq, Ukraine, Yugoslavia, the New Earth, the Baltic, Black and Japanese seas, the Persian and Gulf of Mexico, oil and coal mining areas in many regions of the world, etc.

Unregulated population growth, which led to the expansion of energy production and as a consequence - to the active pollution of nature, acid rain, the formation of ozone "windows", greenhouse effect, the emergence and spread of diseases, impoverishment of most of the planet's population, also caused the fact that today around 10 million children are doomed to semi-starvation, nearly 200 million are consuming inferiors while consuming substandard foods and water.

The billion of the poorest on the planet have the highest number of children and replenish legions of gills aces and patients. In the struggle for survival, they are forced to cut down the remains of forests, destroy wild animals, fish, birds, and choose valuable natural resources for the rest, without concern for their conservation or reproduction. At the same time, one billion of the world's richest people consume most of their natural resources, commit unprecedented waste and produce the lion's share of waste. For example, European environmentalists have estimated that the United States has burned practically all the oxygen and supports energy processes by "sucking" it from adjacent regions. With 6% of the world's population, this country consumes about 40% of the Earth's natural resources and accounts for about 60% of all pollution on the planet.

Today, 43 billion people are consumed with oxygen, energy and industry by transporting enough oxygen.

If mankind consumes water at the same accelerating rate as it has been before, then by 2100, fresh water supplies will finally be exhausted.

A study of the dynamics of human consumption of mineral resources showed that somewhere in 200-250 years on Earth, stocks of oil, coal, shale and peat will end. If modern industrial and energy technologies are maintained, approximately 2/3 of the world's oxygen reserves

will be depleted in approximately the same period, with a steady decline in its rate of reproduction by green plants (as a result of degradation of the biosphere, reduction of forest area, biodiversity, bio-biodiversity).).

Currently, the average life expectancy in the US, Canada, Japan, Western Europe is 73-75 years, and only 9 children out of 1000 die at the age of 5. At the same time, the average life expectancy in Latin America, South Asia and Africa is 65 57, 52 years, respectively, and 80-95 children per 1,000 people die in the age of 5, and 150 or more children in environmental disaster zones (Aralia, Ethiopia). 1000 people.

According to 00H materials, about 250 million people use low-quality drinking water. In this case, the average North American inhabitant consumes water 70-75 times more than a resident of Central America or the Arabian Peninsula, and 70% of all fresh water consumed in the world is irrigated, although nearly half of it is lost. reaching the root system of the plants.

Resource absorption and waste production. In the last 100 years, humanity has increased the speed of its movement in space 100 times, 1000 times the use of energy resources, 7 million times the military power, hundreds of millions times the speed of communication, information exchange and resolution. various scientific and practical problems with the help of electronic computers. At the same time, mankind produces 2000 times more waste than the rest of the biosphere.

The world industry now produces 7-100 times more goods and produces 3-4 times (by weight) more minerals than 25-30 years ago. To meet its growing needs and increase the comfort of its existence, man has developed to an extremely high level energy, chemical, petroleum-refining, mining, metallurgical and light industries, mechanical engineering, transport, communications. Every year, humanity produces more than 3.5 billion tonnes of coal from the Earth's interior, using approximately 10 million tonnes of oil and its products daily. Its influence reached the farthest corners of the globe and even spread to the outer cosmos and planets of the solar system.

Today, more than 50,000 chemicals used by humans are adversely affected by all living things in the biosphere. About 250,000 new chemical compounds are synthesized annually in the world, 1,5,000 harmful substances poison the atmosphere, and about 10,000 - water and soil. Most of these synthetic substances (especially new ones), like some man-made wastes, are not recyclable by nature because they are "foreign" to ecosystems, but accumulate, poisoning the environment.

More than 600 million vehicles annually emit nearly 400 million tonnes of carbon oxides, 100 million tonnes of hydrocarbons and hundreds of thousands of tons of lead into the earth's atmosphere. Industrial enterprises, thermal power plants, motor transport and aviation industries burn more than 5 billion tons of oil and about a trillion cubic meters of gas annually. In the

reservoirs of the world annually discharges about 500 billion tons of industrial and householdwaste, includingalmost 10 million tons of oil waste.

Annually, world industrial and agricultural production generates about 2.5 billion tonnes of solid waste, including 0.5 billion tonnes of reactive and poisonous substances. Almost 1 million tonnes of radioactive waste have been stored in various parts of the world today.

2.5 Changing the environment by man

Man not only spontaneously influences the environment because of the results of his production activity, but also changes it according to his needs. The most common environmental changes include the construction of housing, highways, railways, power grids, various military sites, artificial reservoirs, hydroelectric power stations, etc.

Directional changes of the environment are: plowing of virgin and re-log lands, various reclamation works, redistribution of water resources, regulation of surface runoff and hydrological regime of rivers, plantation of forests with ameliorative, agricultural or aesthetic purpose, creation of various protective structures against floods, erosion, erosion landslides. This list could be significantly expanded and expanded. The main thing is not just to list them, but to establish general patterns that could be used to manage environmental impacts [56,70].

Each deliberate environmental impact of a person causes adverse changes in it, that is, those that are not intended for the main purpose of the impact and often reduce its positive effect. For example, in irrigation of arid lands, groundwater is mostly raised. The following processes occur: water, rising, dissolves the salts contained in the lower soil layers, and capillary current brings them to the surface. As a result, the soil is re-salinized. Drainage of peatlands and peat extraction, plowing of fertile soils cause significant changes of their hydrological regime. From this it follows that during a deliberate impact on the environment, a person must anticipate all its possible consequences in order to prevent the adverse effect.

So, to summarize the above, let us emphasize that human beings influence the environment in the process of: mining; agricultural work (agriculture, animal husbandry); deforestation; industrial production; use of all types of transport; production of electricity.

Let's look at these impacts more specifically.

Adverse effects of industrial production on the environment are:

- creation of physical bodies and substances that do not exist in nature (machines, devices, chemicals, synthetic materials, etc.);

- atmospheric pollution by various emissions (gaseous, liquid and solid);
- pollution of the hydrosphere by industrial runoff;
- soil contamination by waste (heavy metals, pesticides, radioactive elements, etc.);
- exhaustion of fresh water supplies;
- formation of industrial noise;
- consumption of non-renewable natural resources.

The negative impact of agriculture on the environment is manifested in: the destruction of many species of natural vegetation in large areas and the replacement of a small number of species of cultivated plants; destruction of natural habitats of animals; destruction of soil cover in case of irrational use (water and wind erosion, soil swamping, contamination with excess fertilizers and pesticides); pollution of surface and ground water by fertilizers, pesticides, fuel residues, lubricants; atmospheric pollution by agricultural machinery exhaust gases and the like.

The impact of agriculture on the environment is significant due to the large scale of this type of human activity. Some scientists believe that much of modern deserts are former agricultural territories (Sahara Desert, Oleshkovsky Sands in southern Ukraine).

Livestock as an agricultural sector is related to land-slavery, but it is a separate kind of human activity. It has specific forms of environmental impact: the destruction of natural vegetation through congestion of pastures; pollution of surface waters by animal husbandry waste; atmospheric pollution by toxic gases, germs; animal waste is a potential source of infectious agents - brucellosis, tuberculosis, etc.

Wood is called green gold, meaning its special value and universal economic value. During deforestation, the environment is adversely affected: the destruction of wild animals and their natural habitats; disturbance of the oxygen balance of the region; degradation of soil at logging sites; increased soil erosion, landslide areas, siltation of rivers and lakes; pollution of the year during wood fusing; climate change.

Given the above aspects of the problem, the following features of human impact on the environment should be noted:

1. Man influences the natural environment in the process of production and use of natural resources, which leads to its significant changes. The future existence of mankind is possible only under conditions of global control over the state of the environment at the international level.

2. Different components of the environment change quantitatively and qualitatively under the influence of production and consumption according to human needs.

3. In the case of irrational use, humans can transform renewable natural resources into non-renewable, both regionally and globally.

It is known that when 5 g of oil gets to the surface of the soil, all organisms in the area up to 50 m2 are destroyed, and when 10 g of gasoline is contained in 1 m3 of water, all living things are killed there (up to 5 kg per day of fuel loss).

Exhaust air changes as atmospheric air changes, while its relatively stable composition is of paramount importance to all living organisms. The flue gas is a mixture of about 200 substances, many of which are harmful. These include carbon oxides (II and IV), sulfur oxide (IV), aldehydes (including potent formaldehyde), and toxic compounds of lead. Most of these gases are heavier than air, so they accumulate near the Earth's surface. Because of this, a child in the cradle breathes a lot more toxic substances than walks with a walking stroller on the sidewalk with heavy traffic.

Of all types of disturbance of natural equilibrium through economic activity, the greatest consequences are environmental pollution.

Each year 5 billion tonnes of solid waste, 250 million tonnes of fine aerosols, 200 million tonnes of carbon monoxide (II), 151 million tonnes of sulfur oxide (II), 50 million tonnes of nitrogen oxides are emitted into the biosphere annually. More than 10 million tonnes of oil, 300 million tonnes of iron, 6.5 million tonnes of phosphorus, 7 thousand tonnes of mercury are stored annually in the oceans. During the last 150 years, as a result of mining, 100 km3 of waste heaps and over 50 km3 of quarries have been formed. The annual movement of rocks and soil during construction and agricultural work is more than 4 thousand km3. Each year, over 600 million tonnes of mineral fertilizers and 5 million tonnes of pesticides are sprayed on agricultural land, a third of which is flushed into water or left in the atmosphere. The direct objects of pollution are the atmosphere, water, soil, and the victims of this pollution are human, plants, animals.

In order to understand the dynamics of anthropogenic load on the environment, let us say that nowadays the world industry produces 7 times more goods and uses three times (by mass) more minerals than in 1970.

From the ecological point of view, pollution means not simply getting into the atmosphere, soil, water of foreign components. Excess of certain substances or the usual presence of foreign substances in the natural environment leads to a change in the living regime of living beings. Therefore, from the environmental point of view, environmental pollution means the introduction into the ecological system of non-living or non-living components and the structural changes caused by it, which disrupt the circulation of substances, normal life, which causes the ecosystem to collapse or reduce its productivity. When, for example, water is diverted from cooling systems to

natural reservoirs, their temperature is changed. Deviations from the natural state of noise, lighting and the like can also be considered as pollution. From an environmental point of view, even hunting is an active form of environmental impact. For example, for a wild duck population, factors such as its physical destruction, the reduction of habitats during commercial use of reeds where the wild duck builds nests, and the pollution of habitats by industrial runoff and the destruction of eggs by nests in nests are equally negative.

Scientists say that in the next 30 years, due to technological changes in the environment, the world may lose more than 1 million species of plants and animals. The rate of extinction of species today is a thousand times greater than the rate of their natural extinction. At the same time, biodiversity is the key to sustainability of all ecosystems and the biosphere as a whole. The life of humans depends on the state of ecosystems and therefore, biodiversity loss should be considered as one of the major threats to human existence on the planet.

The environmental impact of mining is very diverse and manifests itself in direct and indirect effects on natural landscapes. For example, in the United Kingdom, the development of minerals in an open-ended way has led to the degradation of agricultural land at a site of 70,000 hectares (of which more than 20% is occupied by careers). It is estimated that up to 640 hectares of land, manganese up to 600 hectares, and coal up to 100 hectares are mined during the extraction of 1 million tonnes of iron ore. Mining contributes to the destruction of vegetation, deformation of areas of the earth's surface, the emergence of man-made forms of relief [65,76].

Indirect action is manifested in the change of groundwater regime, underflooding and waterlogging of soil, which ultimately leads to an increase in human morbidity. Mining also pollutes the atmosphere, causing dust and gas pollution. It is estimated that 200,000 tonnes of dust are supplied from underground mines and gypsum mines; as a result of coal production in 4000 mines of the world - 27 billion m3 of methane and 17 billion m3 of carbon dioxide.

Mining also has a negative effect on the Earth's interior, because they dispose of industrial waste, radioactive waste (there are 246 underground landfills in the US alone).

According to the UN, nearly 100 countries and over 1 billion people live today in arid zones that are, to varying degrees, affected by desertification. Annual losses from desertification are estimated at at least $ 50 billion. USA.

2.6 The main man-made pollutants of the natural environment

Part of the biosphere, covered by the impact of human activity, its technical means, objects that are working or under construction, is called technosphere. It began to form in the XVIII-XIX centuries. at the same time with the rapid development of science and technology until the second half of XX century. has become a force on a planetary scale. This is due to the intensification of human activity and the emergence of new factors of negative impact on nature: the development of nuclear energy, the development of new weapons, chemicalization of agriculture, the further development of all modes of transport, mining, metallurgical industry, mechanical engineering and space exploration. As a result, pollution of all environmental components - air, water, soil, food - has increased. In the biosphere, the processes of migration of substances caused by human production activity began, and a third kind of circulation of substances in nature (except geological and biological) - technological, was formed. There was a need to study in detail, to classify various man-made environmental pollution, to anticipate them, to be able to prevent them, to reduce, to neutralize, and finally, to combat the effects of various negative human actions on nature. This has led to the development of many new areas in the field of applied ecology, commonly referred to as "technoecology".

The main man-made pollutants of the natural environment are various gases, gaseous substances, aerosols, dust, which are emitted into the atmosphere by objects of energy, industry and transport, radioactive, electromagnetic, magnetic and thermal radiation and fields, noise and vibration. , "Industrial" enriched by harmful chemical compounds industrial waste, municipal and household waste, chemicals (especially pesticides and fertilizers), which are used extensively in agriculture, petroleum products [56,59].

Today, more than 7,000 chemical compounds are released into the environment through industrial production, many of which are toxic, mutagenic and carcinogenic.

The most common and dangerous air pollutants include nitrogen dioxide, benzene, water - pesticides, nitrates (nitric acid salts), soil - polychlorinated diphenyls, hydrochloric acid. The number of man-made pollutants is now enormous and, unfortunately, continues to increase. Heavy metals are a particular hazard, which are increasingly accumulating in soil, water and food.

Annually: as a result of combustion, approximately 25 billion tonnes of carbon dioxide and 150 million tonnes of sulfur compounds are emitted into the planet's atmosphere; world industry discharges more than 160 km3 of wastewater into rivers; about 700 million tonnes of mineral fertilizers and 4 million tonnes of pesticides are added to the soil. In the last 50 years, the use of mineral fertilizers has increased by 45 times and the toxic chemicals by 10 times, although the yield

has increased by only 15 - 20%, but many times the pollution of natural waters, soils and food has increased.

In the most general form, pollutants and environmental pollution are classified as such

- mechanical, chemical, physical, biological in origin; material, energy,

- for duration of action - stable, unstable, semi-stable, of medium stability;

- impact on biota - direct and indirect action; - by nature - intentional (planned), incidental, accidental.

Mechanical contaminants are various solid particles or objects (thrown away as unnecessary, waste, unused) on the Earth's surface, in soil, water, in space (dust, debris from machines and apparatus).

Chemical contaminants are solids, gases and liquids, chemical elements and compounds of artificial origin that enter the biosphere and disrupt the natural processes of circulation of substances and energy (especially dangerous - chemical weapons).

Physical pollution is a change in thermal, electrical, electromagnetic, gravitational, light, radiation fields in the environment, noise, vibration created by humans.

Biological contamination is the emergence of new species of living organisms (such as AIDS) in the wild as a result of human activity, the increased pathogenicity of parasites and pathogens, and the catastrophic reproduction of certain species (for example, by unjustified introduction). , quarantine violations, etc.).

Material includes various atmospheric pollution, sewage, solid waste, energy - thermal emissions, noise, vibration, electromagnetic fields, ultrasonic, infrasound, light, laser, infrared, ultraviolet, ionizing, electromagnetic.

Long-term pollutants (plastics, polyethylene, some metals, glass, radioactive substances with a long half-life, etc.) are persistent.

Unstable pollutants decompose quickly, dissolve, neutralize in the natural environment under the influence of various factors and processes.

Deliberate pollution is deliberate (prohibited) illegal emissions and discharges of hazardous waste from production into water bodies, air and land, deliberate destruction of forests, pastures, overfishing, poaching, quarrying, misuse of land, natural waters and etc.

Concomitant pollution is the gradual change in the state of the atmosphere, hydrosphere, lithosphere and biosphere in certain areas, regions and the planet as a whole as a result of human activity (desertification of swamps, disappearance of small rivers, the emergence of acid rain, greenhouse effect, ozone depletion).

The following are the cnbck characteristics of the most common and dangerous environmental pollutants.

Carbon monoxide (CO), or carbon monoxide, has no color or odor, resulting from incomplete combustion of coal, natural gas, wood, oil, and gasoline. If the air contains 1% CO, it already has a negative impact on the biota, and 4% for many species is a lethal dose. One car emits about 3.65 kg of CO per day; the density of car flows on the main highways of Kiev reaches 50-100 thousand cars per day, hourly emission into the air of CO makes 1800-2000 kg.

Nitrogen oxides (N0, N02, N20), which are 10 times more hazardous to humans than CO, are emitted mainly by enterprises producing nitric acid and nitrates, aniline dyes, celluloid, viscose silk, as well as fuel aggregates. TPPs and TPPs, metallurgical plants and cause the formation of acid rain. In the territories bordering the main highways of Kiev (10 - 30 km), concentrations of N02, 10 - 30 times higher than the maximum permissible (MPC), gasoline - by 10 times.

Ammonia (NH3) used for production, in particular nitric acid, irritates the respiratory tract of humans and animals.

Harmful hydrocarbons (aromatic, paraffins, naphthenes, benzene) are contained in car exhaust gases (imperfection of gasoline combustion processes in engine cylinders), crankcase gas and gasoline vapors. Soot is also very harmful (because it absorbs pollutants well), unsaturated (olefin) hydrocarbons (ethylene and others), which make up 35% of the total hydrocarbon emissions and is one of the reasons for the formation of smogs - photochemical fogs in giant cities. The car exhaust contains about 200 harmful components, the most dangerous of which are benzypyrenes, nitrogen oxides, compounds of lead and mercury, aldehydes.

Sulfur dioxide (S02), or sulfur dioxide, is released during the combustion of sulfur (coal, petroleum) fuel, the processing of sulfur ores, the burning of waste heaps, and the smelting of metals.

Sulfur trioxide (S03), or sulfuric anhydride, is formed as a result of oxidation of S02, in the atmosphere during photochemical and catalytic reactions and is an aerosol or solution of sulfuric acid in rainwater, which acidifies soils, enhances corrosion of metals, destroys gum , dolomite, causes exacerbation of lung and respiratory diseases. It is accumulated in the areas of chemical, oil and metallurgical industry, thermal power plants, cement and coke plants. It is also extremely harmful to plants, as it is easily absorbed by them and disrupts metabolism and development.

Hydrogen sulfide (H2S) and sulfur carbon (CC2) are released into the air separately and together with other sulfur compounds, but in smaller quantities than SO2 by the enterprises that

produce artificial fibers, sugar, as well as refineries and coke plants. The characteristic feature of these pollutants is a sharp, unpleasant, irritating odor. They have high toxicity (100 times more toxic than SO2). In the H2S atmosphere, it slowly oxidizes to SO2. It also gets into the atmosphere in volcanoes. In addition, under natural conditions, hydrogen sulfide is the end product of sulfate-reducing bacteria - at the bottom of swamps and rivers, lakes, seas and even in sewage systems.

Chlorine compounds with other elements concentrate around chemical plants that produce hydrochloric acid, pesticides, cement, superphosphate, vinegar, hydrolysis alcohol, chlorine, soda, organic dyes, and the like. The atmosphere is contained in the form of molecular chlorine and hydrogen chloride.

Fluoride compounds with other elements accumulate in areas of production of aluminum, enamel, glass, ceramics, porcelain, steel, phosphorus fertilizers. They are contained in the air as hydrogen fluoride (HF) or dusty fluorite (CaF2). Fluoride compounds are extremely toxic and are highly sensitive to insects. Fluoride is accumulated in plants, and through plant feed - in the body of animals.

Lead (Pb) is a toxic metal contained in automobile exhaust gases, lead paints, coating materials, insulation of electrical cables and water pipes, various gaskets, etc. The human body contains an average of about 120 mg of lead, which is distributed across all organs, tissues, bones. It is removed from the bones very slowly (decades)! Organic lead compounds enter the human body through the skin, mucous membranes, with water and food, and inorganic - through the respiratory tract. Today, a major city resident inhales approximately 20 m3 of air with lead-containing exhaust gases, receives it with food (up to 45 mcg), and holds up to 16 mcg of lead in the body, which enters the bloodstream and distributes into the body. bone (up to 90%), liver and kidney. Sometimes the total amount of lead in a citizen's body is up to 0.5 g or more, while his MPC in the blood is 50 - 100 mcg / 100 ml.

Cadmium (CD) is one of the most poisonous substances. Its MPC is 0.001 mg / l. For example, in 1956, in Japan, a severe bone disease known as itai-itai was caused by chronic poisoning of human cadmium contained in rice. This rice was grown near a mining plant that heavily polluted the surrounding area with cadmium-containing waste. Up to 600 mcg of this poison was daily released into the body of Japanese people living nearby!

According to the World Health Organization (WHO), nowadays, in the USA, almost 50-60 mcg of cadmium enters the body of an adult, in Sweden - 15-20, in Japan - up to 80 mcg. The only thing that saves is that the majority of cadmium is excreted very quickly, and only about 2 mcg (a

day) remains. Increased cadmium content is observed in marine phosphorites, marine plants and fish bones, in some polymetallic ores. It accumulates in the ashes when burning landfill.

Mercury (Hg) is a highly toxic substance, especially organometallic compounds - methylmercury, ethyl mercury and others. It gets into the environment from spent Mercury (Hg) is a highly toxic substance, especially organometallic compounds - methylmercury, ethyl mercury and others. It gets into the environment from spent.

doubles, zinc and lead compounds will increase 10 times, mercury, cadmium, strontium - 100 times, arsenic (arsenic) - 250 times!

It is important to emphasize that in modern conditions atmospheric air, water, soil are simultaneously polluted by several harmful substances. Each of them, taken separately, may have a concentration lower than the MPC (ie not a health hazard), but the combined effect of all the pollutants has a strong negative effect, as is the case when the MPC of any toxicant is far exceeded. . This phenomenon is called the summation effect of harmful substances, or synergistic effect. An example is the combined strong negative effects of sulfur dioxide and hydrogen sulfide, acetone and phenol, acetaldehyde and vinyl acetate, nitrogen dioxide and formaldehyde, sulfur dioxide and nitrogen dioxide, mixtures of strong acids (HCI, H2SO4, HNO3, HNO3, HNO3) and some heavy metals, radiation and pesticides, radiation and noise [38-40].

Environmental policy implementation can only be successful if it is based on a sound regulatory framework, which includes environmental legislation and a broader system of by-laws establishing the distribution of political and administrative functions between legislatures, as well as regulatory and enforcement instruments. Ecological and economic relationships in society are embodied in a particular model of behavior of the individual, their groups and organizations. The traditional attitude of citizens to the law and the measures of its compulsory implementation influence the effectiveness of environmental legislation in the process of environmental policy implementation [9,30].

Some societies are more adherent to the rules than others, and these rules are not always legal rules, often based on customs and moral traditions. As a result, several systems of law (both written and unwritten) may exist at the same time, the effectiveness of each of them is influenced by the other. The legal framework within which environmental legislation is developed is usually established by a constitution that defines the distribution of political power and authority and establishes environmental principles that form the basis for the development of environmental legislation.

On the one hand, constitutional rights, combined with the right to go to court about environmental matters, can create opportunities for citizens. obtain compensation for damages caused by particularly significant environmental damage. On the other hand, it is not clear whether a constitutionally recognized environmental right can directly create a citizen's enforceable right to sue the government on environmental issues, since courts often do not dare to take responsibility for influencing policy. In addition, such an approach appears to be less effective and a real means of securing citizens' environmental rights than others, such as putting in place a mechanism for public participation in the administrative governance process.

Efforts to extend human rights laws by incorporating environmental rights provisions have been counterproductive (for example, in the United States in 1970). They were also unable to be included in the European Convention on Human Rights. The legal foundations of environmental regulation have evolved through the sporadic adoption of laws and by-laws over many decades that apply to specific industries or to various environmental components. For example, in the UK, the first Environmental Laws concerned the reduction of air pollution (1853) and the prevention of river pollution (1876). As a result of the lack of a systematic approach to the creation of environmental legislation, duplication and contradictions arose in the distribution of administrative powers.

The success of environmental legislation depends on how well environmental legislation reflects environmental priorities, compatible with existing legislation and the legal system in general (with historical administrative and institutional basis) and how real it is by enforcement and enforcement.

Courts play a special role in the legal system of environmental management. The extent of their impact on the implementation of environmental policy in different countries is different: in the UK, Germany and France, this impact is negligible; in the Netherlands and Sweden - slightly larger. In the US, on the contrary, litigation in environmental lawsuits is very common. However, litigation often entails a considerable amount of time and expense in implementing decisions, so that more and more recognition is obtained by resolving disagreements through negotiation and agreement between regulators and environmentalists.

In countries where the constitution exists, courts are usually entitled to hear cases concerning legislative and administrative decisions, which is not the case in countries where the constitution does not exist (UK). In general, the role of courts in environmental management in Europe, America and Japan is significantly different. In Europe and Japan, courts do not play a significant role in enforcing environmental legislation; in most countries, courts do not have the

power to hear cases of the lawfulness or constitutionality of legislation, and if they do, they are rarely used.

In the Netherlands and the UK, the role of the courts is mainly to take coercive measures against malicious violations of the law, although in the United Kingdom, judicial review of inappropriate decisions is increasingly common. In France and Germany, citizens can, through court, seek to reduce pollution from certain sources. In Germany, citizens can also, through court, prohibit the implementation of a proposed project if it directly affects them. In Japan, this is practically not the case, but in the 1970s, the courts here made widely known decisions to pay significant compensation to victims of some major air and water pollution by mercury, methyl-mercury and cadmium, which caused mass diseases.

In the United States, courts are widely involved in environmental regulation cases, which review the constitutionality of laws, soak up ambiguities, verify the clarity and appropriateness of delegation of administrative authority, and review the procedures and justifications used by environmental authorities in developing environmental governing documents. In addition, they, along with the concerned government bodies, are actively involved in the enforcement of laws, the handling of environmental offenses and the punishment of perpetrators.

One of the attractive features of the American system is its openness to the influence of citizens, which is why courts have a significant impact on the system of environmental management, in particular on the political creation and enforcement of laws. In essence, every step of the legislature, policymaker, representative of the regulatory body or interested private groups is made by looking at what decisions can be made by the court. The result is a system in which the adoption of a regulatory document is only an intermediate step in the long-term struggle that determines the practical effect of the proposed policy or regulation.

Critics of the open, cumbersome judiciary in the US have drawn attention to the heavy waste of time, money, and human energy resulting from the lengthy litigation that is typical of environmental management cases. These shortcomings of traditional politicization have been felt in the United States itself, leaving here have always been looking for less confrontational approaches. One is to negotiate with those affected by the regulatory process in order to reach a consensus between them and representatives of the state government on controversial issues. This approach is expected not only to reduce the number of court cases, but also to promote a more successful implementation of environmental policy, so it is increasingly used both at the federal and state levels.

With regard to Europe, the role of the judiciary in handling environmental cases, in particular as regards compensation for pollution damage, is increasingly felt. In some European countries, especially Scandinavian countries, there has been (in Sweden since 1809) a government official or complaint body (ombudsman) whose task is to ensure that citizens' rights are not violated by the government. Recently, such bodies have begun to pay much more attention to the environmental rights of citizens, and this activity is being carried out in close cooperation with democratic media and generally considered useful.

An important part of the environmental management system is its administrative and institutional framework, which makes it possible and supports the process of formulating environmental policy and ensuring its implementation and enforcement. Executive bodies, designated and empowered by representative legislative bodies, form the basis of the environmental administration. Frequent changes in the administrative status of public environmental authorities in developed countries confirm the view that the development of institutions should be gradual. The status of the bodies of state ecological management, but the priority given to the problems of environmental protection by the higher bodies of legislative and executive power [5,12], is important not only.

Administrative and institutional frameworks are an integral part of the environmental management system, which enables and supports the process of environmental policy-making, as well as ensuring the implementation and enforcement of policies. Central to the environmental administration is the government agencies that are set up and mandated by representative elected bodies to perform their respective functions.

In the process of economic development, sectoral ministries and agencies have been responsible for regulating and overseeing productive activities, as well as for their impact on people and the environment. In the United States, for example, the disposal of waste in rivers began to be regulated from the late 19th century to ensure normal shipping conditions, but environmental protection was subordinated to the industrial goals of the sectoral authorities and their inability to comply with national environmental interests became increasingly apparent.

In response to growing public concern for environmental issues, mass media appearances In the late 1960s, governmental environmental agencies began to set up and increasingly focus on these issues in international relations in different countries, drawing on the commitment of Governments to address environmental problems. Later than in other countries, this happened in Germany, where the Federal Ministry of the Environment, Reserves and Nuclear Safety was

organized in 1986. Usually, these governmental environmental bodies were created by delegating to them functions of other existing public authorities while giving them new functions.

The creation of these institutions was evolutionary. Very often, they did not have real authority to implement environmental policies. This was due to two reasons: the lack of genuine political will at the top levels of government to introduce change and resistance from some circles in the process of implementing existing institutional, legal and administrative relations. In Japan, for example, in the 1970s, the national government demonstrated a reluctance to take responsibility for the implementation of environmental policies, while continuing to give priority to economic development over environmental issues. However, over time, under public pressure, the state of affairs began to change in favor of environmental interests.

There is some uncertainty about the need to combine or separate the functions of permitting (licenses) for environmental management and environmental inspection. In the Netherlands, for example, the enforcement function performed by the environmental inspectorate is separate from the licensing function. In addition, enforcement of environmental legislation is entrusted to environmental police, special courts and enforcement agents. In the UK and Japan, licensing is coupled with inspection, the benefits of such a combination are not clearly defined.

At the micro level (that is, at the enterprise level), compliance with environmental regulations, as well as finding and implementing effective solutions to pollution problems, requires changes in the collective management philosophy and practices that affect not only production processes and product characteristics, but also such areas, as financial and price accounting and capital expenditure planning. Therefore, to improve the environmental performance of the enterprise, comply with regulatory requirements and, at the same time, increase competitiveness requires a combined effort in the management of production, finance and marketing (marketing).

There are a wide range of tools for implementing certain measures, from rigid administrative-command (AK) to purely market-oriented (PO).

The backbone of the AK is that governments must set rules to be followed by everyone who influences the environment. These rules are clearly stated orders that indicate which technologies or processes should be used to meet their regulatory requirements (technological standards), what the mass and concentration of substances in emissions and discharges (emission standards) should be, or when and where manufacturing activities (permits for business placement) may take place. The requirements of the AK approach are clearly defined and their results are predictable. However, the AK approach is considered to be conceptually imperfect and difficult to implement due to

government intervention in enterprise management (so-called micromanagement), a wasteful system;

RO tools are focused on the use of economic levers to achieve acceptable environmental quality. In an economically motivated system, the pollutant has a wide choice of decisions to regulate, based on his knowledge of product prices and costs, which vary according to accepted biological policy. In a competitive environment, the market encourages the updating of production technologies and equipment, which is why it is not the government itself, but the industry itself, which undertakes the task of finding effective and inexpensive methods that reduce environmental pollution, as well as implementing them if it is cost-effective. Theoretically, economic motivation can provide the same or even better environmental status compared to the AK system, with significant cost savings, increased efficiency and reduced involvement of the government. However, critics of POs in policy implementation instruments indicate that the theoretical benefits of this approach have not yet been substantiated by practical experience.

In practice, until recently, AK approaches have dominated. For example, in the United States, national standards have set back-water discharge standards for all major sources of water pollution based on requirements that meet the best available technology (BAT, Vevey Awaiia Teppoioeu). In Germany, BAT requirements and appropriate emission limits are set for specific industries for a large number of pollutants, broken down into three groups, taking into account their toxicity, stability, bioaccumulation potential and carcinogenicity.

In the Netherlands, the use of the best technical means (NTZ, Vei1 Tesppisi Meaph) is required in the case of highly toxic substances and the best practical means (refineries, Veyai Rgassi Meieh) for all other toxic substances, whereas to regulate the discharge of non-toxic substances in non-toxic water jekti (water quality goals -AtiepiI Oiaiaiiu Oesiiue).

In the UK, since 1990, not only technical is taken into account not only the cost-effectiveness but also the cost-effectiveness of using the BAT concept that does not cause unnecessary costs (Ve $ 1 Auaiiiiie TESPOIioeu po Epiaiip Ehsezh Sozi) as well as the Principle of Best Practical Environmental Choice (Veya Rgassiapi. However, in the absence of a clear methodology for assessing cost effectiveness, the choice of technology requires individual analysis in each case and leaves considerable room for the final decision by the regulatory authority.

As experience shows, the AK approach, which has taken root in practice, is very difficult to change. For example, in the US, an attempt was made to impose a charge for water pollution because this charge:

- was considered as an additional tax;

- was perceived as conferring a "right to pollute"; was at odds with the view that only legislative measures could meet social needs;

- provoked resistance from industrialists who viewed the payment as an additional financial burden that could reduce their profits.

Non-governmental environmental organizations have often objected to the introduction of economic instruments because they were not convinced that these instruments would achieve the same environmental improvements as AK instruments. Recently, however, as a result of the gradual identification of both the complexity of the nature of pollution problems and the need for cost-effective solutions to them, in most developed countries, views have changed in favor of the use of RA tools. This was facilitated by the demonstration of the successful results of the implementation of a number of market-oriented environmental regulation programs.

In 1996, the share of environmental taxes in the total tax amount was: US - 3.2%, France - 4.9%, Japan - 5.5%, Germany and the Netherlands - 6.1%, Sweden - 6.3%, Great Britain - 8.2%. In many countries, indirect environmental taxes have been found to be more appropriate than direct taxes, especially for taxes on environmentally hazardous raw materials, as well as on products such as fertilizers, pesticides, rubber tires, and packaging materials. Differentiated tax policies have been successfully implemented in several countries to encourage the use of cars that consume less fuel and pollute the environment, as well as the use of less harmful fuel. In the USA, positive results were obtained from the implementation after 1990 of an economic mechanism for the sale of permits for emissions into the atmosphere (sulfur dioxide, lead, chlorofluorocarbon).

In Ukraine, financing of environmental protection measures is carried out at the expense of the State Budget of Ukraine and local budgets, funds of enterprises, institutions and organizations, environmental funds, voluntary contributions and other funds. Fees for the special use of natural resources are established on the basis of the rates of fees and limits for their use [42].

Economic measures for environmental protection include:

- interrelation of all management, scientific, technical and economic activity of enterprises, institutions and organizations with rational use of natural resources and efficiency of environmental protection measures on the basis of economic levers;

- identification of sources of financing for environmental protection measures;

- setting limits on the use of natural resources, emissions and discharges of pollutants into the environment and on the generation and disposal of waste;

- setting standards for the collection and amount of charges for the use of natural resources, emissions and discharges of pollutants into the environment for the generation and disposal of waste and other harmful effects;

- providing enterprises, institutions and organizations, as well as citizens of tax, credit and other privileges in the implementation of low-waste, energy and resource-saving technologies and non-traditional types of energy, implementation of other effective measures for environmental protection;

- compensation in accordance with the established procedure for damages caused by violation of environmental legislation.

The rates of collection for the use of natural resources are determined by the packaging of their distribution, quality, reproduction, accessibility, complexity, productivity, location, recyclability and disposal of waste and other factors. Standards, as well as the procedure for its collection are set by the CMU. Limits on the use of natural resources are set in the order determined by regional, city councils, except when natural resources are of national importance and national importance - in accordance with the established CMU order.

Fees for the use of natural resources within the limits set for the costs of production, and for excessive use and reduction of their quality are charged to the profit that remains at the disposal of enterprises, institutions, organizations or citizens. Charges for environmental pollution are set based on the limits of emissions and discharges of pollutants into the environment and waste disposal.

Emissions and discharges of pollutants into the environment from the generation and disposal of industrial, agricultural, construction and other waste and other harmful effects in the whole of the territories of cities, cities of national importance or of individual regions are set: in cases where this leads to pollution of natural resources of republican importance, territories of other regions, - Ministry of Energy Resources; in other cases - in accordance with the procedure established by the regional, city councils, upon the submission of the Ministry of Resources. The procedure for setting standards for collection and collection of charges for environmental pollution is defined by the CMU.

Charges for enterprises, institutions, organizations, and citizens for emissions and discharges of pollutants into the environment, waste disposal and other types of harmful effects within the limits are related to production costs, but not more than 0.15% of gross costs for mining and metallurgical enterprises. , and exceeding the limits will be charged to the profits that remain at the disposal of businesses, institutions, organizations or citizens. The procedure for setting limits on the amount of charges for environmental pollution is defined by the CMU. Fees for the deterioration of

the quality of natural resources (reduction of soil fertility, forest productivity, fishery reservoirs, etc.) as a result of ownership and use are established on the basis of standards. The procedure for setting standards for collection for the deterioration of the quality of natural resources is defined by the CMU.

Charges of enterprises, institutions, organizations, and citizens for the deterioration of the quality of natural resources due to their ownership and use are made at the expense of the profit that remains at their disposal. Charges for the use of natural resources come to local budgets and the State Budget of Ukraine and are directed to the implementation of works on the reproduction, maintenance of these resources in proper condition. Charges for the use of natural resources of local importance are paid to local budgets and credited to the respective budgets in accordance with applicable law.

Funds from the environmental pollution levy are distributed between local (rural, urban, urban) and oblast, as well as the State Environmental Funds (hereinafter - the State Fund) in the ratio established by law. The funds from the environmental pollution levy by the enterprises of the mining and metallurgical complex are distributed between local (rural, urban, urban), oblast and State funds in the established legislation. ohm ratio.

For the misuse of these funds, enterprises are subject to penalties of 100% of the amounts used for non-purpose purposes with a penalty of 120% of the National Bank of Ukraine discount rate. The allocation of funds for the use of natural resources coming to the State Budget of Ukraine is carried out by the VRU. The distribution of funds for the use of natural resources coming to local budgets is carried out by the respective regional and city councils of People's Deputies on the submission of the Ministry of Energy.

State and local environmental funds are formed to finance environmental measures. Local funds are formed as part of the relevant local budget at the place of causing environmental damage at the expense of: fees for environmental pollution; parts of monetary penalties for violation of environmental rules and regulations and damage caused by violation of environmental protection legislation as a result of economic and other activities in accordance with the current legislation; targeted and other voluntary contributions from businesses, institutions, organizations and citizens. The distribution of fees to local funds is carried out by the respective regional, city councils upon the submission of the Ministry of Resources.

The state fund is formed at the expense of: deductions from local funds of environmental protection, the amount of which is determined by the VRU; voluntary contributions from businesses, institutions, organizations, citizens and other income; part of fees for the use of natural

resources, the amount of which is determined by the VRU at the request of the CMU. The funds allocated to the State Fund are distributed by the CMU upon submission of the Ministry of Energy Resources.

Local and State funds may be used only for targeted financing of environmental and resource conservation measures, including research into the state cadastre of territories and sites of PFP, as well as measures to reduce the impact of environmental pollution on public health and stimulation of employees of specially authorized state bodies in the field of environmental protection and use of natural resources, except for persons having the status of civil servants, and public inspectors for protection to stakes, found violations of environmental legislation and take the necessary measures to bring the perpetrators to justice, prevent violations of environmental legislation.

The regulations on local funds are approved by the respective Councils, and the fund is approved by the CMU. Other funds may be formed in Ukraine to capture and finance measures for environmental protection, sustainable management of natural resources and environmental protection.

Promoting the rational use of natural resources, environmental protection is carried out by:

- granting taxation privileges to enterprises, institutions, organizations and citizens, in the event of their implementation of measures for the rational use of natural resources and environmental protection, the transition to low-waste and resource-and energy-saving technologies, the organization of production and implementation of treatment equipment and equipment for disposal and disposal waste, as well as environmental monitoring devices and sources of pollutant emissions and discharges, implementation of other measures aimed at improving environmental protection;

- granting short-term and long-term loans on preferential terms to implement measures to ensure the rational use of natural resources and the environment;

- establishment of high rates of depreciation of the main production environmental funds;

- exemption from environmental taxation;

- transfer of part of the funds of environmental protection funds under contractual terms to enterprises, institutions, organizations and citizens for activities for

- guaranteed reduction of emissions and discharges of pollutants and reduction of harmful physical, chemical and biological impacts on the environment, on the development of environmentally safe technologies and industries;

- providing natural resources as collateral;

- Promoting in the established CMU the order of employees of specially authorized state bodies in the field of environmental protection and use of natural resources, except for persons having the status of civil servants and public environmental inspectors who have found violations of environmental legislation and have taken the necessary measures to attract liability as well as the development and strengthening of the material and technical base of specially authorized state bodies in the field of environmental protection at the expense of part of yahnen and other income related to the violation of environmental legislation, credited to the relevant current account of these bodies.

In Ukraine, voluntary and compulsory state and other types of insurance of citizens and their property, property and income of enterprises, institutions and organizations are provided in the event of damage caused by environmental pollution and deterioration of the quality of natural resources.

In order to ensure the protection and efficient use of atmospheric air, organizational and economic measures are introduced to provide for the establishment of limits for pollutant emissions into the air and other harmful effects on it; limits on the use of air as raw material for basic industrial use; the standards of payment and the amount of payments for emissions of pollutants into the air and other harmful effects on it; standards for payment for exceeding emission limits, other harmful effects and issuing permits for the use of atmospheric air; standards for payment for the use of atmospheric air as raw material for the main industrial purpose; as well as providing businesses, institutions, organizations and citizens with tax, credit and other privileges in the implementation of low-waste, non-waste, energy and resource-saving technological processes, implementation of other environmental measures in accordance with the law [3,12].

Emissions of pollutants into the atmosphere from stationary sources are set for enterprises, establishments and organizations taking into account the maximum permissible emission levels and are communicated to them as provisionally agreed values of pollutant emissions for each component. They are established for enterprises by the Ministry of Energy Resources in the form of emission permits. The GDRs of the harmful effects of physical and biological factors on the atmospheric air are established by the Ministry of Health. The procedure for setting limits for pollutant emissions into the air and the levels of harmful effects of physical and biological factors is defined. CMU.

Payments for pollutant emissions into the air and for other harmful effects are levied on businesses, institutions and organizations. Collection of payments does not exempt compensation

for losses caused by violation of the legislation on the protection of the air. The amounts of these payments are set by the regional state administrations on the basis of the limits of pollutant emissions and other harmful effects on it and the rates of payment for them. The procedure for setting standards for payment and collection of charges for air pollution and for other harmful effects on it is defined by the CMU.

The charge for the use of atmospheric air as a raw material for the main industrial purpose is established on the basis of the norms of its use and the standards of payment per unit volume of atmospheric air. The procedure for establishing standards for the use of atmospheric air as raw material for basic industrial purposes, standards for payment and collection of fees for it is set by the CMU. The distribution of payments for air pollution, other adverse effects on it and for the use of atmospheric air as raw material for primary industrial use shall be carried out in accordance with applicable law.

The general use of natural plant resources in Ukraine is free of charge, and the special use is paid. The amount of the fee for the special use of natural plant resources is determined taking into account natural reserves, distribution, value, reproductive capacity, productivity of these resources. The procedure for determining the fee and the rate of payment for the special use of natural plant resources is set by the CMU. Fees for the special use of natural plant resources of national importance shall be credited to the respective budgets in accordance with the law, and the local value shall be credited in full to the respective local budgets.

The following are exempt from the fee for the special use of natural plant resources: research institutions, educational and educational establishments carrying out scientific researches of flora objects for the purpose of their protection, non-wasteful use and reproduction, except for the use of wild vascular plants, bryophytes and algae , lichens, and fungi of the species listed in the Red Book of Ukraine, and natural plant communities listed in the Green Paper of Ukraine; land owners; users (including tenants) of land, with the exception of the use of wild vascular plants, bryophytes, algae, lichens, as well as mushrooms, species of which are listed in the Red Book of Ukraine, and natural plant communities included in the Green Paper of Ukraine, for Satisfaction with natural plant resources of own needs without the right of their realization.

MF Reimers formulated several rules and laws of social ecology that need to be known and obeyed [80,81]:

- the rule of socio-environmental equilibrium (discussed above);

- the principle of cultural development management (the ideas of nature-centrism and co-evolution must be based on new ecological cultures and morals);

- the rule of socio-ecological substitution (transitions to more extensive and technological types of management become the cause of ecological crises, and these latter provoke socio-economic crises that turn into political ones);

- the law of socio-ecological irreversibility (the development of humanity cannot move from the later stages to the initial stages);

- the law of the noosphere VI Vernadsky (in the sense that when mankind does not begin to reasonably regulate its numbers and pressure on nature, in view of its laws, the species Nomo sarieps will disappear). There are many examples in history of how in some regions the resource-ecological crisis has grown into a socio-economic and political one. At present, humanity is on the verge of another crisis, but no longer a regional one, but a global resource-ecological one, capable of causing far more serious consequences for man and the biosphere than before (such as the collapse of the Mayan civilization, the civilizations of Central and Central Asia).

2.8 Economics of nature management

The first concept of "nature management" was proposed by the Russian ecologist Yu. M. Kurazhkovsky in 1959. By its definition, nature management is the regulation of all types of use of natural resources for economy and health care.

MF Reimers [80] defines nature as all forms of exploitation of natural resource potential and measures for its conservation (extraction and processing of natural mineral and biological resources, their restoration, protection of natural living conditions, natural systems, etc.).

The development of productive forces, the growth of environmental management and the rate of environmental pollution while depleting natural resources, the deterioration of the health of the able-bodied population, the decline in labor productivity - all this led to the formation of the economy of environmental management - a new branch of science that studies the methods of the most effective human impact nature to maintain dynamic equilibrium, the circulation of substances in nature. The costs associated with maintaining this equilibrium go to preserve the most economically favorable conditions for the reproduction of material goods, both now and in the future.

Since the environment performs such vital functions as providing people with natural resources, natural services (recreation, tourism, aesthetic pleasures), absorption of waste and pollution, it is important to know the economic value of this and the implementation of nature

conservation measures and the use of its resources. the cost of damage caused to nature by anthropogenic pollution and impacts [56,65].

The criterion for the efficiency of human activity until the middle of the XX century, as mentioned in the previous sections, was to obtain maximum benefits at minimal cost and uncontrolled, predatory exploitation of natural resources, and the basic principle of the attitude to nature - its dominance and complete submission to man. .

After an objective analysis of the causes of environmental disasters and the enormous economic losses from unreasonable management that humankind has suffered in recent decades, it is clear that the principles of environmental management must be different if we are to survive.

Pollution is, first and foremost, an economic problem, which is to be defined by economic terms.

Therefore, the leading principle of environmental management in our time has become ecological and economic, under which the criterion of economic efficiency is formulated as follows: obtaining the maximum material benefits with minimal costs and minimal environmental damage. But it does require a large investment in the environmental sector, which always significantly reduces the profitability of production.

Therefore, environmental and economic interests are still confronted, and, unfortunately, others are overwhelmingly overwhelmed: deforestation is favored over their use for recreation, the development of the tourism business over the conservation of a rare landscape or lake, and offshore oil fields. conservation of marine ecosystems, etc. It is difficult to make a comparative economic assessment of different natural resources today and in the distant future. Today, the value of natural goods and services is either undefined or underestimated, which often leads to anti-environmental decisions, to a distorted assessment of economic development through traditional indicators of gross national product, which is often accompanied by environmental degradation.

Several approaches have now been developed to determine the economic value of natural resources and services. The most comprehensive approach is based on the total economic value, which includes the cost of destroying, restoring and protecting nature.

For the ecological and economic evaluation of construction projects and programs, they use a cost-benefit comparison method and are guided by three criteria: net present value, internal rate of return, and cost / benefit ratio. The main tasks of the environmental economy:

- determination of losses caused to the economy (state), industry, enterprise, district, individual private economy or a particular person due to irrational use of nature, violation of laws, norms or rules of nature protection;

- determining the amount of costs needed to eliminate the effects of negative man-made environmental impacts in the near and distant future;

- assessment of the absolute and relative effectiveness of the costs of nature protection and restoration, the choice of the best options for nature conservation activities and the use of natural resources;

- development of economical methods of management of environmental work and ways of stimulating environmental activities and greening production.

The environmental economy needs to gradually move beyond the conservation economy.

Nature management, as mentioned above, can be rational and irrational.

Environmental management is a highly efficient, environmentally sound management that does not lead to dramatic changes in the natural resource potential, but also supports and enhances the productivity of natural complexes or individual objects, and enhances them. It is aimed at ensuring the conditions of existence of humanity and the stable receipt of material goods.

Nature is considered irrational, as a result of which nature loses its capacity for self-reproduction, self-purification and self-regulation, breaks the balance of biosystems, depletes material resources, deteriorates recreational, health and resort conditions, aesthetic characteristics of landscapes, conditions. These are usually extensive, predatory, overfishing, overgrazing, air, water and pounds pollution, industrial, transport, energy emissions and toxic chemicals. Non-rational use of nature may be intentional or accidental or incidental (such as devastation, destruction or fires related to hostilities).

Irrational use of nature can be caused by planned economic and project miscalculations, temporary and forced loans to nature (transitional periods of construction of new states, major natural disasters, wars, etc.), negligent accounting and assessment of natural resources, lack of low environmental protection due to low budgetary arrears. economy, the imperfection of production technologies, poaching, unauthorized construction, etc.

Indicators of losses from environmental pollution are: increasing the level of morbidity; decrease in agricultural productivity; acceleration of depreciation of fixed assets, etc. The cost of nature restoration is determined by the necessary costs of land reclamation, restoration of ponds or farmland, landscaping and the like. However, it is often impossible to assess the deterioration of the social climate, the disturbance of ecosystem equilibrium, the loss of techno-genetic effects of unique geological sites or landscapes, the disappearance of many species of plants and animals.

It is especially difficult to assess the effects of anthropogenic negative impacts on nature when it is necessary to provide a long-term forecast of losses from irrational use of nature.

Conservation costs today can be calculated quite simply and relatively accurately based on current standards and regulations using a number of formulas (these are presented in new textbooks and manuals on environmental economics).

Environmental measures have not only an economic effect (saving the costs of treatment and social insurance of patients, improving labor productivity, increasing bio-productivity, improving the landscape, etc.), but also social - improving the mood of people, reducing their migration, deterring conflicts, reducing crime and reducing crime e [18,39].

The most important problems of the economy of nature management include the correct (objective) assessment of natural resources.

Economic assessment of natural resources is a monetary expression of their economic value. Land, natural water, soil, air, minerals, forest, fauna and flora, recreational facilities should be priced. The rates of payment for the use of natural resources are determined taking into account their geographical location, distribution, quality, reproducibility, accessibility, complexity, productivity, possibility of waste disposal, processing conditions.

The following indicators are used to estimate the value of natural resources:

- labor costs for attracting a resource to social production (extraction of mineral or biological raw materials);

- the effect of using the resource in production (the value of materials, objects, products received from the resources);

- projected labor costs for resource recovery (if possible);

- estimated costs for repayment of losses caused to the natural environment during the development of this resource.

Resource assessment can be individual and complex.

There are three types of individual assessments: 1) assessing the public utility of natural resources; 2) cost estimates (taxes, prices); 3) market prices (licenses). They are performed for each element of the environment, and their values do not always coincide.

In carrying out large-scale environmental assessments of the negative impact of humans on the environment, they use such concepts as environmental damage from pollution of certain components of nature - water, air, land resources. Environmental damage is a reduction in the environmental benefit of its anthropogenic transformation (primarily pollution). They are calculated by the sum of the various costs of society associated with environmental change and its return to its former state, the cost of offsetting the risk to human health.

For larger estimates of environmental damage, they resort to special formulas that can be used to find out about damage to land resources, damage from emissions into the atmosphere or into water bodies. They are listed in the following documents approved by the Ministry of Security of Ukraine:

- Instruction on the procedure for calculation and payment of environmental pollution charges;

- Methodology for calculating the amount of compensation for damages caused to the state as a result of violation of legislation on the protection and rational use of water resources;

- Methodology for calculating the damages caused to fisheries due to violation of the legislation on environmental protection;

- Methodology for calculating the amount of compensation for losses caused to the state as a result of excess emissions of pollutants into the atmosphere.

Natural resource charges are the costs of an enterprise associated with the use of some natural resources and are determined in accordance with the methodology adopted in the country; at the same time the resources are divided into those that buy from someone, those who take »directly from nature, those that are property of production. The cost of such resources is different.

There are several types of environmental taxes [12]:

- rent payments (for example, for the use of waste land);

- taxes and / or penalties for contamination above the established standard;

- taxes on the actual amount of pollution.

At the same time, the pollution tax should be high enough for businesses to be more proficient at protecting the environment than polluting it.

Environmental licenses (ELs) are securities that give the right to specific pollutant emissions for a specific period of time and in specific volumes. These rights may be sold by public authorities to enterprises and one enterprise to another. The price of EL depends on the time of day, season, situation in the region.

Pollution quotas trading is the most flexible of all known methods of economic regulation of environmental quality.

Addition to EL is environmental uncertainty insurance.

Recently, licenses have been introduced for deposits - securities that entitle the mining and sale of minerals.

In the course of a comprehensive economic assessment of environmental measures, the following procedures are envisaged:

- determination of net economic effect;
- evaluation of industrial wastewater treatment options;
- assessment of options for the purification of atmospheric pollution;
- evaluation of waste treatment options;
- assessment of technological solutions;
- evaluation of design decisions;
- ecological expertise of projects;
- accident risk assessment.

In Ukraine, as well as in other modern states, the formation of the system of economic regulation of environmental protection has begun:

- payments for the use of natural resources and pollution of the environment are introduced;
- created environmental funds, banks;
- started trading in environmental licenses, quotas, etc.

Due to the fact that during the transition to a market economy, there are great difficulties and difficulties not only of an economic nature but also of an environmental one, the following should be taken into account:

- the market can be used to effectively limit its' destruction of nature;
- the mechanism of spontaneous market demand and supply does not provide protection of nature - necessary intervention from the outside;
- market quotations based on scientific environmental standards can be used to regulate environmental management;
- the economy should be developed in accordance with a planned strategy that provides for extracurricular forms of control;
- Effective environmental management of economic development requires politically organized forces that represent the immediate and long-term interests of the entire population and are able to withstand the narrow interests of entrepreneurs and those who, directly or indirectly, benefit from polluting industries.

MF Reimers formulated several laws of nature, among which can be named [81]:

- Law of Comprehensiveness of Natural Resources;
- Law of growth of scientific intensity of social development;
- Law of reduction of natural resource potential;
- The law of the cumulative effect of natural factors;
- The law of declining (natural) fertility;

- Law on Increasing the Circulation Rate of Attracted Natural Resources;
- Law of the inevitable chain reactions of "hard" nature management;
- Law of territorial ecological balance;
- The law of recoil.

It is accepted that the laws of nature management are manifestations of certain causally caused phenomena. According to the famous ecologist D. Chiras, nature develops and functions according to four basic principles [70,95]:

1) recycling or reuse of essential substances;

2) constant renewal of resources;

3) conservative consumption, when living beings consume only as much as they need;

4) population control - nature does not allow explosive growth of populations, regulating the number of individuals of one or another species by creating appropriate conditions for its existence and reproduction.

Most of these and other environmental principles and laws were successfully summarized by American ecologist B. Commoner in 1974, reducing them to four laws [81].

Law One: Everything is connected to everything. Ecology views our planet's biosphere as a complex system with many interconnected elements. These connections are realized by the principles of negative feedback (remember, for example, the system of "predator-victim"), direct connections (in ecosystems "all actions of logical algebra -" or "," and "," not "), And thanks to a variety of mutually exclusive interactions. Due to these connections, harmonious systems of circulation of substances and energy are formed. Any interference with the work of a balanced mechanism of the biosphere elicits an immediate response in many directions, making ecological forecasting extremely difficult.

Law Two: Everything has to go somewhere. The example of the biological cycle shows that the remains and products of life of some organisms are in nature a source of existence for others.

Man has not yet created such a harmonious cycle in his business activities. Any production constantly creates at least two things - the necessary production and waste. Waste does not disappear by itself: they accumulate, re-engage in the cycle of substances and lead to unintended consequences.

Law Three: Nature Knows Better. "Lives are made up of many thousands of different organic compounds," B. Communer writes, "and at times it seems that at least some of them can be improved by replacing them with some artificial variant of natural substance." The third law of ecology states that the artificial introduction of organic substances that do not exist in nature, but

created by man, but involved in the living system, are more likely to cause harm. One of the most amazing facts in the chemistry of living substances is that for any organic substance produced by living things, there is an enzyme capable of decomposing it in nature. Therefore, when a person synthesizes a new organic compound that is significantly different in structure from natural substances, it is likely that it does not have a degradable enzyme and that substance will "accumulate". The second law helps to understand the consequences of such an accumulation.

Law Fourth: Nothing is given for nothing. “The global ecosystem is a single unit within which nothing can be lost or lost and cannot be the object of general improvement: everything that is removed from human labor must be recovered. Paying for this bill cannot be avoided, it can only be postponed, "- writes B. Commoner. The fourth law states that natural resources are not endless. Nowadays, in the course of its activity, a person takes into nature a debt of some of its products, leaving as a guarantee those wastes and pollution that cannot or will not be prevented. This debt will grow until the existence of humanity is threatened and people are fully aware of the need to eliminate the negative consequences of their activities. This elimination will require very large costs, which will be the payment of this debt.

3 SUSTAINABLE ECO-ECONOMIC DEVELOPMENT

Scientific publications, speeches by politicians, scientists and statesmen often address environmental and economic problems and use such concepts as "raw materials, energy and product crises", "environmental catastrophe", "man-made disasters", "sustainable development", etc. [96]. It is not a tribute to fashion, but rather a consequence of the genesis of the human community, the result of the interaction of society with nature and the continuous growth of one person's needs for food, water, raw materials and energy [48].

3.1General principles of balanced ecological and economic development

Many papers [76,83] have convincingly proved that social development is conditioned by three groups of factors: the environment, productive forces and industrial relations. There is a close relationship and interplay between these factors. In particular, equilibrium in nature must be ensured by greening productive forces, and the latter must be formed by greening industrial relations. The productive forces include a large set of components that interact to determine the final results of the production of material goods. The main productive forces include, first and foremost, an environment with a wide variety of natural resources, where producers function, maintain their consumption and reductions, and where concentrated human settlements produce and consume material, social and cultural goods. That is, the environment is the basis, foundation for the existence, functioning and development of mankind and its productive forces [31-33].

People with their intellect, productive qualifications, spiritual world are the main ones, and science is the direct productive force of society. Means and organizational forms of production, transport communications, information systems, movement of finances and capital are integral components of productive forces. For the normal functioning of all mechanisms of production in modern, extremely dynamic conditions of social development, all these functionally dependent economic categories need coordination and docking. At the same time, the greening of production and environmental protection of the environment should become a priority in their development.

Not only ecologists but also economists, politicians and representatives of various industrial and agricultural industries are needed to counteract the environmental dangers arising from intensive economic activity. Only in this case can we focus on the model of sustainable, environmentally balanced and environmentally sound socio-economic development. The Sustainable Development Strategy assumes that the development of productive forces in modern

conditions must be more closely aligned with the available natural resources, their reproductive and assimilation potential. Moreover, the level and nature of the use of natural resources, especially land, water and mineral resources, the scope and directions of financing environmental programs, the orientation of technological and organizational progress must be consistent not only with the current but also with the perspective needs of the population of the country and its regions [8,23].

This model implies the setting of strict environmental standards, standards, requirements and restrictions for individual industries and enterprises of the region, basins year, places of natural resources development and more. At the same time, the concept of sustainable ecological and economic development should not be seen in terms of achieving a system of indicators in the appropriate terms, but as a direction in which society, the state, its regions, and even individuals today, tomorrow and in the future should move. This approach requires the education of each person a broad and deep ecological worldview, a careful attitude to nature, understanding the dominance of natural wealth over the created human material values, awareness of the reasonable need for their own needs, lack of consumer psychology, aggressiveness, selfishness, self-interest in law of the whole society.

The realities of the global catastrophe became especially noticeable in the second half of the twentieth century, when the processes of intensive population growth and scientific and technological progress were combined. Stimulated by World War II, scientific and technological progress led not only to positive trends: a marked increase in labor productivity and well-being of the population, but also caused irreparable damage to the natural system. It is in the last decades that the world has really felt that the man-made capacity of the environment and the natural resources that provide life are too limited.

In June 1992, the first UN World Conference on Environment and Development was held in Rio de Janeiro, under the auspices of the United Nations, which outlined the principles of sustainable societal development. Two basic documents were adopted at this conference: the Declaration on Environment and Development and the Global Agenda for Agenda 21 [16,35,93].

The term "sustainable development" is an approximate translation from the English language of the phrase "sustainable development", which is often used in the understanding of such economic development that eliminates irreversible changes in the natural environment. The concept of sustainable development of society still needs a comprehensive scientific interpretation, full of deep ecological and socio-economic content, but today it has already become accepted and is the basis of modern ideas about the future development of the world community. The Rio de Janeiro

Conference identified and adopted 27 general principles, which are a prerequisite for a society's transition to sustainable development. It should be noted that the governments of the countries (179 countries out of 185 UN members), which signed the documents of this conference, have undertaken to develop and adopt national concepts of sustainable development. The following mandatory principles must be laid down in their basis, according to the adopted Action Program [93,96]:

- people are the main concern and the main driver of sustainable development. They have the right to a healthy and productive lifestyle in harmony with nature;

- the provision of mental development and human health is the main task of the life of every society;

- determination of a reasonable and sufficient limit to meeting one's own material needs;

- the desire to protect the Earth's major ecosystems and to acquire knowledge of natural resources management

- adopting the concept of an open economic system and the principles of fair trade;

- harmonization of national environmental policies and creation of international pro-environmental structures;

- development of citizens' rights and activity.

Thus, the concept of sustainable ecological and economic development should be understood as an effective system of use of natural resources, reproduction of their individual varieties, perfect organizational and economic model of functioning of the economy, stable technical and economic renewal of production, its greening, accumulation of finances and capital for socio-economic development regions, the state and society as a whole. It should be noted the general humanistic orientation of the stated principles, means and goals of sustainable development. In order to financially support the new socio-economic development of the world community, the Rio de Janeiro Conference proposed that all countries allocate 0.7% of annual gross national income.

In its most generalized form, the concept of sustainable development of society is focused on the optimal satisfaction of people's needs, ensuring a sufficient quality of life, rational use of natural resources and preservation of the environment and creation of preconditions under which:

- the political system must ensure the participation of the general public in all important decisions;

- the economic system must be able to organize advanced production and scientific and technological progress on its own basis and to preserve the natural resource base;

- the social system is designed to relieve the stresses that arise in the process of economic development;

- the technological system should stimulate a constant and effective search for new optimal solutions;

- the power structure must be flexible and capable of self-correction and self-improvement;

- the international system should promote trade and financial ties on a mutually beneficial basis.

Thus, from the point of view of purposeful activity sustainable development should be considered as the result of dynamic interaction of certain systems according to the type indicated in Fig. 3.1.

Fig. 3,1 (out of 93)

It should be noted that the regional level is the main carrier of the general goal of society, which introduces the concept of sustainable development and should become the basis for creating conditions for the normal spiritual, cultural and psychophysical development of a person within the definition of a sufficient limit of his needs and consumer interests.

The direct development of models of balanced ecological and economic development of the regions, their territories requires consideration of the regional and sectoral structure of the economy, a clear allocation of priority directions of development, taking into account the specificity of resources and interests of the population living in these territories [13].

Thus, the transition to sustainable development determines the strategy of cooperation between the states in the 21st century, especially in the issues of preserving the biosphere and the existence of the human race. The main goal of a society that adopts the concept of sustainable development should be the desire to create conditions for normal social and physical development and preserve human health within the framework of ensuring a sufficient limit to its material needs, ie within the limits of consumer interests of society.

3.2 Conceptual principles of sustainable development

Transformation processes in the economy are an inherent feature of its functioning. In a global dimension, they, depending on the level of development of economy and society, can mean [73,93]:

- change of one formation to another or transition of society from agrarian to industrial, later to post-industrial, and further to informational;

- transition from the planning and distribution system to the market system.

Each such change is conditioned by the development of an economy that, like all of our society, is undergoing a continuous process of change that is largely dependent on the transformational processes that dominate the world today.

For Ukraine, the main conditions in this context are:

- dominance of the market model of economic development;

- the impact of globalization on the state of economic change;

- domination of integration processes over national and social ones;

- the impact of technocratization on social development;

- greening of all spheres of life.

At the same time, due to the current situation on the planet, the issue of environmental preservation comes to the fore regardless of the economic level of the country's development.

The urgency of this problem is due to the fact that in Ukraine today the natural resources and mechanisms of regulation of the natural bases of life are extremely degraded [8]. They are not capable of supporting an effective socio-economic development process in the long term. Therefore, it is necessary to thoroughly and thoroughly study the mechanisms of functioning of the natural foundations of life and steer them towards sustainable ecological and economic development. The main methodological prerequisite for sustainable development should be considered as the priorities of socio-economic progress and the quality of the environment. Only on such an integrative basis can the adequacy of the interests of ecology and the economy be dominated by the dominance of environmental criteria, requirements and indicators. Proper environmental quality in the process of sustainable ecological and economic development should become not only a necessary prerequisite, but also an end result. This is possible only in the process of a comprehensive approach to solving this problem.

Characterizing the process of state formation, as a rule, the main attention is paid to its political-ideological, socio-economic and geopolitical components. Human activity, its mentality and value system are mainly emphasized in the sphere of production and consumption. All-planetary is a tendency to increase economic indicators, the desire to achieve a high standard of living. The ecological aspect has not been taken into account until recently. At the same time, all the problems and problems of society, directly or indirectly, are related to the deteriorating environmental situation. Particularly dramatic, from this point of view, is the situation in Ukraine,

where the economy is saturated with raw materials and energy-intensive mining, metallurgical, chemical industries, outdated technologies. They complicate the environmental situation in the country and lead to irrationality in the location of production facilities, their excessive centralization and lack of economic priorities. In addition, in times of economic crisis, attempts are being made to systematically sell non-consumable food and manufactured goods from the West to Ukraine, to introduce outdated technologies and production in the form of investments. Our country is gradually becoming a raw material extraction region and a place for disposal of especially harmful, chemical and biologically toxic and radioactive waste in Europe.

An important condition for sustainable development is the recognition of a sufficient limit to meet human needs, that is, the restriction of consumer instincts of the individual and society as a whole. In the face of political crisis, degradation of the financial system, lack of public confidence in government institutions, declarative calls for enhancing the ecological culture and consciousness of the masses are no longer able to improve the socio-economic and environmental situation.

Gradually, humanity has come to the conclusion that it is no longer possible to achieve sustainable development of a modern urban society by merely improving the system of nature management. This approach allows humanity only to correct the consequences of their own destructive actions. The global problem of balancing the ideas of economic development and conservation of the environment (UN Conference, Rio de Janeiro, June 1992) proposes the following [93,96]:

- economic development in detachment from ecology will lead to the transformation of the Earth into a desert;

- ecology without economic development perpetuates poverty and injustice;

- ecology without the right to action is impossible, the right to act without ecology is the way to collective destruction.

In the history of mankind can be distinguished three periods, which are characterized by certain relationships of society with the environment:

- the first - man changes and transforms nature, but depends on it;

- the second is dominated by the changed nature and the person is convinced that he can use it indefinitely;

- third - nature changes very quickly and irreversibly, there are problems of expediency of human existence.

It can be argued that ecology has acquired a fundamentally new meaning since the then Secretary-General of the United Nations, U. Tan, declared a well-known report in 1969, which for

the first time linked the phenomena of demographic avalanche, natural resources exhaustion and environmental pollution to qualify as a catastrophic approach to global ecology. In economically developed and educated countries, aware of environmental problems, they were forced to quickly accept this imperative and began to adapt the economy to the environment [124].

In recent years, there has been a shift of ecology from the ideological sphere to socio-political, that is, the ecology of sociology. In this approach, it is considered that environmental problems arise when, for certain reasons, the stability of material, energy, biological and information systems is disturbed in nature. It has been proved [24,27] that the root cause of 90% of environmental problems is inadequate, poor-quality information served by society, 10% are natural phenomena. Therefore, the main object and content of modern social ecology should be considered the information that is produced and managed by society, shaping their systems of life and changing the environment. Over time, it is becoming increasingly clear that it is impossible to provide conditions for optimal development of society without taking full account of the possible environmental consequences of all socio-political and economic projects. In particular, when forming comprehensive economic plans and programs, there is a need to take into account socio-political, demographic, energy-raw materials, technological, information and other factors. Further, in order to identify optimal forms of human interaction with the environment, in addition to factors of anthropogenic origin, it is necessary to take into account possible changes in the biosphere. That is, ecology plays a powerful integrative function, because its heuristic and organizing role is manifested both in the field of rational use of nature, and in making complex political and economic decisions, in the processes of state formation and concepts of further development of mankind.

In order to implement the idea of a sustainable, environmentally balanced development of society, focused on optimal satisfaction of people's needs, ensuring a sufficient quality of life, rational use of natural resources and preservation of the environment, it is necessary, first of all, to rethink the principles and strategies of the society's further existence. Environmental information, environmental laws, in addition to environmental orientation, have a pronounced socio-political character. A modern politician, a civil servant of any rank should be competent in environmental issues as well. The speed of the process of overcoming the current energy and raw materials crisis depends on what the environmental policy in the country is and how the governing bodies operate. On the other hand, the issues of state-building, the formation of national consciousness and patriotism, the problems of freedom and human rights all have a certain environmental sound. Ecological and economic ideology can become a consolidating factor in all of humanity, because the impending catastrophe creates an instinct for self-preservation in the human community. In

environmental terms, the division into the poor and the rich loses all meaning. Figuratively speaking, all of us (both individuals and states) are in the same boat (our planet) that sails in the turbulent ecological sea. Modern man must understand his involvement in all the processes that occur in nature, in it must feel responsible for the proper functioning of the entire biosphere complex, which is the guarantor of the existence of human civilization. Only deep environmental knowledge and beliefs can be the basis for shaping a socially just society, that is, an effective public policy. Therefore, not only the concept of rational use of natural resources, but above all the laws of nature development, should be based on ecological education and consciousness, it is necessary to focus on the social functions that ecology in modern society should perform. The most important social functions of ecology include worldview, educational, valeological, adaptive, predictive, environmental, informative, creative, artistic, epistemological [41,42].

The main educational function of ecology is to help people to understand their place and role in the natural environment and to determine the strategy of their behavior in the material, energy and information space of the biosphere.

It is almost impossible to solve modern environmental problems only with technological innovations and rationalization of nature management. This requires a systematic, integrated approach. Guided by it, the Cabinet of Ministers of Ukraine has developed and submitted to the Parliament the National Program for Conservation of Biological Diversity for 1998 - 2015, seeks to make adjustments to the current plans for socio-economic development of the country and regions, sectoral targeted programs, and takes other measures. Their implementation will help to prevent irreversible loss of flora and fauna gene pool, will help to maintain ecological balance in the territory of Ukraine, improve demographic situation, social structuring, fulfill the country's international obligations to protect biodiversity, as well as to attract financial and financial support social crisis.

An integral part of the mentioned program is the preservation of the Carpathian Mountain Eco-Corridor, ensuring its integrity with the ecological networks of neighboring countries. In particular, it is envisaged that its implementation will optimize the recreational and tourist potential here, introduce new economic mechanisms, improve the system of environmental education, education and information, expand international cooperation, regulate migration processes and more.

Decisive in solving existing environmental problems is the process of greening the educational process, ie the formation of environmental consciousness of society [1,36]. This is

possible only on the basis of deep philosophical, socio-political and psychological-pedagogical understanding of the content of human existence, social norms of existence of civilization and realization of continuous environmental education as a necessary condition for transition of Ukraine to the concept of sustainable development. Education is designed to shape in each person a broad ecological worldview, understanding of the dominance of natural values over artificially created material goods, awareness of reasonable limits of their own needs, willingness to voluntarily subordinate personal interests to the laws of nature, the interests of society.

Globally, social ecology and other new branches of knowledge, which should be more actively introduced into the national pedagogical practice, are intended to contribute to the comprehensive solution of the ripe problems. An important and perspective direction of optimization of the society and the environment is the formation of modern scientific foundations (foundations) of Ukraine's environmental policy. It can be interpreted as a system of specific political, economic, legal measures taken by the state for the rational use of natural resources on the territory of the country, In other words, its purpose is to achieve a harmonious, dynamically-balanced development of economy, society and nature. In our view, the components of such a policy include [96,110]:

- formation of a new legal and economic mechanism to regulate the environmental, economic, military and other environmental impact;

- improvement of environmental legislation and its testing and adaptation in the new socio-economic model emerging in Ukraine;

- development of standardization, certification and licensing in the field of ecology, taking into account the requirements for inclusion of our country in the international system of ecological safety;

- creation of a unified system of state environmental monitoring;

- promotion of environmentally friendly and resource-saving technologies;

- development of the Institute of Environmental Expertise;

- introduction of entrepreneurship in the field of ecology;

- widespread involvement of citizens in decision-making in this area;

- strengthening international and regional cooperation in the field of nature protection;

- creation of a system of continuous environmental education and upbringing.

With the joint efforts of specialists of different industries, it is advisable to develop a draft concept of transition of Ukraine to sustainable development, which would take into account our

capabilities, needs and specificity. The most important elements of such a concept could be the following provisions [96-99]:

- all people in Ukraine have the right to a secure, healthy and creative life in accordance with nature;

- each region and its population is responsible to society and the world for the use of its natural resources, the environment and social development;

- no one has the right to harm the neighbors' environment;

- a humanistic demographic policy is needed everywhere;

- environmental protection is an integral element of socio-economic development;

- its main purpose is overcoming poverty, poverty, equalization of life of people in different regions, zones, settlements, on other grounds;

- real development must ensure the right to preserve the natural environment for future generations;

- environmental pollution is the same responsibility of different branches of government, public institutions, each person;

- production and consumption models that do not contribute to sustainable development should be excluded from practice;

- major decisions (in economics, technology, infrastructure) at all levels (international, national, local, local) must be made with complete and objective scientific information, taking into account environmental safety and social implications.

The concept of sustainable development is intended to become the methodological basis for overcoming the social crisis of Ukraine, its national revival and joining the world community of civilized peoples and countries in the 21st century.

In the early 21st century, most of the world, including Ukraine, found themselves in the so-called industrial, man-made phase of social development. The socio-economic status and prospects of economic development of such countries are, first of all, determined by the rate of growth of scientific and technological progress. In an effort to move to the post-industrial phase of development, such countries are constantly increasing their man-made impact on natural resources. It is clear that the endless acceleration of the NTP will inevitably bring our civilization closer to a global environmental catastrophe, that is, it does not guarantee, but problematize, its future. The development of an industrial society is at the same time an increase in its instability, and the acceleration of scientific and technological progress can lead to the collapse of technogenic civilization [31,33]. Developed countries that are part of the post-industrial community, with an

awareness of the environmental imperative, are gradually adapting their economies to the environment. The environmental imperative in such countries becomes a powerful impulse not only to improve the production sphere, but also to adapt to the ecology a system of moral and ethical values. This is also due to the fact that the destructive processes in nature, society cause internal anxiety of the person, create conditions for neuroses, the state of general psychosis. It is clear that with the depletion of natural resources, these processes will increase, exacerbate, and extend up to global values.

The term "culture" in the broad sense includes all inherent in man as a biological species, acquired education and socially sanctioned ways of activity and behavior with the results of this activity, including. According to modern ideas, culture is [41,54]:

- material production combined with modern technologies and means of production;
- language and other communication aids through which people communicate;
- a set of social norms, morals, or a system of socially recognized prescriptions, guidelines, prohibitions, customs, traditions that govern human relations.

Ecological culture is the direction of human activity and thinking, on which the normal existence of a modern civilization, its sustainable development in the future, significantly depends. Ecological culture has a long history, it is an attribute, that is, an organic component of human life since its inception. At the same time, it is a phenomenon of the twentieth century, when humankind is increasingly aware of the need to green its life in order to make it safer, healthier.

Culture in the ecological sense creates the conditions for maintaining the balance of people in society and society with nature. It provides for meeting the biological needs of humans with the mandatory conservation of the environment. Therefore, the problem of sustainable ecological and economic development should be considered above all as a problem of individual and collective consciousness, the formation of which is the prerogative of the educational process. Only a high culture in its economic sense will be able to preserve the equilibrium of man in society and society in nature. The state of culture in this territory is shaped by the continuous intellectual and material work of many generations, especially through the media and educational influence.

The carrier of ecological culture is a person in various of its given - generic, separate, individually-unique. Attitudes to the environment by the aggregate humanity, certain ethnicities or communities, the individual is peculiar and determined by the real place of the particular subject in the world, its capabilities and needs. In this sense, ecological culture is a means of self-organization of essential human forces in the context of a particular natural environment [56]. That is why

ecological culture is a phenomenon that is historical, current and changeable in time, and its basic parameters and concepts crystallize in the course of human progress.

In the most general case, the mentality is understood as a set of different mental properties, qualities and peculiarities of their manifestations, which characterize the way of thinking, peculiarities of character, understanding and perception of the surrounding world, its place in it, the level of political consciousness and consciousness of a certain united community. In this sense, mentality acts as an integrative factor that unites the political and psychological community of people who are close in their minds, mindset, perception of the surrounding socio-political reality and averaged actions in appropriate situations, adequately perceiving and understanding each other . Since this concept includes integrative characteristics of a certain united people (political, national or religious, residence, etc.), it is clear that this category is different in different situations. In evolutionary long-term processes, the mentality shows its best conservative traits - allows small peoples to preserve their culture, language, traditions in the environment of a foreign environment (Transcarpathia in Hungary and Austria-Hungary). In dynamic, fleeting situations, the actions of certain united people are largely determined by the actions of their leaders, spiritual leaders. In extremely dynamic, that is, extreme situations, all social changes are accompanied by such manifestations as haphazardness, situationalism, constant uncertainty. The magnitude of negative mentalities during such periods is largely determined by the charisma of the political or national leaders who lead a particular community.

Geopolitically, Ukraine occupies a strategic place between the West and the East, and more precisely between the European and Asian civilizations, and this makes its mark on the mentality of the people. It should always be borne in mind that European countries are laying down temporal priorities at the heart of strategic, economic, and spiritual development, and spatial dimensions in Asian countries. Therefore, all transformation processes (political, economic, spiritual and mental) in our country should be considered not only with regard to spatial orientations (to the European Union or Russia), but also with regard to temporal changes, ie in the chronopolitical and cultural and political world. Neighboring countries, such as Poland, Slovakia, Hungary, Romania and Russia, have a particularly significant influence on the transformation processes taking place in Ukraine and, consequently, on the mentality of Ukrainians in the last decade.

Social and political, and any other motivation is a complex set of spiritual-moral ideals and material-pragmatic interests for each individual. In Soviet times, the priority of collectivist

morality was declared, and individualism and especially consumerism were condemned. Today, the nature of man is interpreted purely selfish, and the essence of his interests is reduced mainly to consumer categories and material values. There are many charismatic leaders who, at an ideological level, have mastered this profound social change and are ready to build on it their political careers, but the mentality of Ukrainians is so fast and simply impossible to change. Therefore, ten years of continuous changes in the spiritual and socio-economic space of Ukraine have led to the degradation and destruction, in the first place, of the production of "material goods", which supposedly subordinates all of the revolutionary activities of society. It is clear that as the number and capacity of tools in the structure of productive forces increases, a person gradually becomes a "servicer" of the material and technical base of society, becomes a simple complement to the created tools of labor, that is, begins to act as a simple "screw" in a large and complex state mechanisms. The process of continuous increase of material values, subordination of the whole variety of requests of the society to material needs, intensively creates in society through the production of impersonal mass of people and leads to the extreme formalization of the whole set of interpersonal connections. For the sake of maintaining high levels of production and high standards of consumption, society is destroying and losing the person behind whom it all began.

However, in society there are always people who do not want to be "screws" of the anti-personal state mechanism, are not amenable to production and consumer standardization and do not subordinate their activities to production and conveyor algorithms. They are able to look at the society, so to speak, from the side, to appreciate its shortcomings and strategically predicted perspective. It is these people who determine the ways and forms of quality upgrading of society and its productive potential, and they are able to initiate radical changes and become leaders in organizing their implementation. The activity and actions of such people are aimed at overcoming the standardization of life, they are the causative agents of social thought, in their activity spiritual and moral aspirations, rather than pragmatic interests, prevail. In general, it can be argued that this particular social group is the embryo of the nation-building energy of the people, because it serves them altruistically and unselfishly. If, however, the share of such people in society is too small and growing, such a state inevitably begins to decline. This is explained by the fact that in such countries, the principle of total pragmatism becomes dominant, in which any proclamation of the priority of the interests of the people is only a delusion that covers their own interests. In such situations, only clans and oligarchs, corruption, and compradorism, the true companions of all decay societies, thrive.

Therefore, for the effective functioning of any social system, in addition to the conventional division of people by professional characteristics (horizontal graduation), it is also necessary to realize the division of labor according to the degree of creative potential of participants in state-building (vertical graduation). Only creative personalities are capable of non-standard solutions, of independence in the search for ways to solve existing social problems. For such individuals, society, by virtue of its benefits, should create optimal conditions for movement through the steps of vertical graduation. At the same time, the desire of the individual to realize his or her creative potential conflicts with the purely pragmatic consumer interest of the majority. Therefore, representatives of the real elite of any social system always appeal to spiritual and moral motivation in the behavior of people. And people, if they have not finally lost the ability to be a people, in critical situations begin to realize that the situation needs to be resolved by the whole community, that is, complementary actions in horizontal and vertical planes. Achieving a positive effect in public life is possible only by mobilizing the efforts of the whole community, and the efforts of solidarity aimed at achieving a common goal, to move forward.

The mentality of the indigenous population of Ukraine in the historical aspect was formed under the influence of several powerful factors. Geographically, Ukraine is located in the center of Europe, at the crossroads of the world's land transit corridors. It is a bridge between the wealth of raw materials and the vastly large markets of the East and the powerful producers of consumer goods in the West. On the other hand, throughout its thousands of years of state-building history, Ukraine has been part of various states that have differed significantly in culture, religion, economic priorities and power, a place in the political life of Europe. Epochs, traditions and customs were changing, only one thing remained constant - Ukraine remained a periphery of any state entity that it belonged to for thousands of years. Therefore, the mentality of Ukrainians, among other recognized factors, was formed under the influence of two extremely powerful, but directed opposite factors - the Central European vector with all its positive components and the peripheral vector with all the consequences of this concept. This is why the indigenous population of Ukraine stands out on the specific pan-European mental background. On the one hand, a preserved culture, traditionally deep religiosity, respect for family values, hard work, tolerance to other nations and religions, law-abiding and peaceful temper.

In relation to the environment at different stages of historical development, Ukrainians were guided by different worldview paradigms, which not only formed under the influence of the achieved level and methods of environmental management, but also, in turn, defined its character.

At the same time, two essential components of regional life, the wealth of the subsoil and the land, have always been considered to be the main ecological and economic factors of the life-process.

The problem of the scientific use of land has especially begun to manifest itself in the last two centuries. It is clear that the magnitude of agricultural land, in the first place, depends on the situation with the product security of the region. Transcarpathia, due to smallholding, has never produced enough basic food (grains, meat, milk). This situation was especially aggravated at the end of the twentieth century. Extremely high rates of urbanization of life and the demographic explosion have caused very high technogenic pressure on agricultural land in Ukraine.

It can be argued that as a result of these objective realities and dominant tendencies, Ukrainians have for centuries been developing a respectful attitude to natural resources, which results in a rather high environmental culture in relation to the surrounding world.

These regional peculiarities are of great importance in the implementation of sustainable environmental and economic development ideas. This is especially true of technical advances that radically alter the natural and intellectual environment, the environment of man and his worldview. The impact of environmental realities on all aspects of our country's political, economic, demographic, socio-humanitarian and spiritual-moral development is so obvious and wide-ranging that it seems, at best, short-sighted and irresponsible.

Not only environmentalists but also economists, politicians and representatives of various industrial and agrarian industries are required to counteract the dangers arising from intensive economic activity. Only in this case can we focus on the model of sustainable, environmentally balanced and environmentally sound socio-economic development. The Sustainable Ecological and Economic Development Strategy assumes that the productive forces, the structure of the economy, the specialization and the location of production in modern conditions must be more closely aligned with the available resources, productive, reproductive and assimilative potential of the environment. Moreover, the level and nature of the use of natural resources, above all land, water and mineral resources, the scale and directions of investment of money and capital, the orientation of technological and organizational progress must be coordinated not only with the current but also with the perspective needs of the population of the country and its regions.

This model implies the setting of strict environmental standards, standards, requirements and restrictions for individual industries and enterprises of the region, basins year, places of natural resources development and more. At the same time, the concept of sustainable ecological and economic development should not be considered in terms of achieving a system of indicators in the appropriate terms, but as a direction in which society, the state, its regions, individuals, today,

tomorrow and in the future should move. This approach requires the education of each person a broad and deep ecological worldview, a careful attitude to nature, understanding the dominance of natural benefits over the created human material goods, awareness of the reasonable need for their own needs, lack of consumer psychology, aggressiveness, selfishness, willingness to legislate nature, the interests of the whole society.

3.3 The genesis of ecological-economic relationships

The rational use and protection of natural resources is practically based on the life activity of every modern society and every state. The content of the concept of nature protection evolves as society, nature and knowledge about them evolve. In the prehistoric period, environmental activities were mystified through a system of prescriptions and prohibitions, which mostly concerned the simple preservation of certain species of trees, religious sites, and the like.

At the beginning of XX century. changes in the environment were seen as a side effect of industrial development, ie as a natural, albeit undesirable, phenomenon. In the 1960s, it was already optimistic that the negative effects of this process could be successfully neutralized within the limits of scientific and technological progress (NTP), which at the time had high expectations in many areas of social life. However, as it has now emerged, scientific and technological progress on a global scale has created environmental problems rather than solved them.

The reason for such an irrational result of NTP should be seen in the methodology according to which environmental problems have long been sought to be resolved within the limits of nature conservation and the rational use of its resources. In the 70's and 80's, a corresponding stamp of this phrase was formed and formed.

What is the essence of the methodology of rationality in nature use?

Rational - the category is historical, that is, variable. its real content is determined by the level of development of productive forces, traditions, customs, and in general - the level of culture. Man, no matter how he manipulates nature, is always convinced that it works expedient, that is rational: using progressive in the beginning of civilization fire preparation of soil or three-tenfold in agriculture in later times, grazing sheep on Crimean eggs (before 1960), draining the Polesie or arranging partitions on the Dnieper. In any case, the basis of the action was confidence in their appropriateness, although in the end, such an attitude towards nature, as a rule, turned to negative economic and environmental consequences.

Replacing "rational" nature management (the 80's - early 90's of the twentieth century) came to the realization that man, by manipulating nature, must take into account a set of economic and

environmental factors, preferring the latter. In practice, this means that when addressing economic issues, the environmental side of the matter must be taken into account, and vice versa.

Thus, in a relatively short period of time, Western countries have included in their economic calculations the environmental component, developed resource and energy-saving technologies, closed cycles and recyclables in production, and introduced many other similar innovations. In addition, a new concept of "quality of life" has been formulated for us, covering the level of consumption and the environmental conditions under which it is consumed. The Declaration of Human Rights was supplemented by a record on the human right to an environmentally safe environment, which was then duplicated by all the constitutions of the world, including the Constitution of Ukraine (Article 40).

Awareness of the depth of the environmental crisis has significantly altered the contemporary image of Western countries that have quickly managed to minimize the effects of environmental problems. Yes, the United States has successfully resolved the problem of reclamation of the Great Lakes, Europe - the Rhine. It should be noted that, as a rule, restoring devastated aquatic ecosystems is extremely difficult and, for the most part, impossible. Tokyo, which until recently was cited as an example of an incredibly polluted city, is now the cleanest city in the world. The structure of the economy of these countries, which have brought dirty production beyond their borders, has also undergone a corresponding change. It is mainly the mining and processing industries that produce the most toxic waste [17,69].

With the participation of the environmental factor more important parameters of the modern world are formed. The transition to "new thinking" in international politics in the late 1980s, which started the chain reaction of fundamental changes around the world, is a direct result of the realization of the possible effects of a fusion winter, an ecological model developed in the former USSR (Academician. M, Moses) and from which it follows that it does not matter in principle whoever presses the feather button in a nuclear confrontation, the result of the day will be one - the global thermonuclear winter.

Experts estimate that 1-5% of global inflation is driven by environmental factors. In the estimated cost of modern projects, 15-20% falls on the environmental component.

Predictors call future inter-state conflicts. not only militaristic but also environmental information. Futurologists say that in 15-20 years, competition for food resources will be more fierce than for energy, and as the planet's population approaches its maximum (12 billion), the problem of living space will sharply arise. Territory (of a modern country from an ecological point

of view is an ecological resource, but one that unlike other resource ss (water, energy, etc.) are not redistributed by means of transportation. The territory is or is not present.

Human development occurs according to the same patterns as all living things. With the proper density distribution, the living substance flows as water flows according to the laws of gravity, not according to the laws of organized society. Some elements of these forecasts are already manifesting themselves.

The basis of the latest international "distribution" of labor also clearly traces the environmental factor, especially in the distribution of natural resources, which are considered as a means of developing productive forces and at the same time as the environment in which people live. The place of each state is strictly determined in a particular niche of globalized economy not only by means of geopolitics, but also by international environmental agreements, which in many cases rightly impose certain restrictions on the free choice of ways of development of a country with insufficient level of technological equipment. Developed countries in this distribution system retain niches that have minimal impact on the natural environment and generate the highest profits. In this globalized model, the poorest countries whose economies are structurally dependent on the economies of rich countries are the most lost, as in the empire the periphery depends on the metropolis. The economic wheels of this globalized machine are spinning so that the poorer participants in the economic process are poorer and the richer are getting richer. The so-called vicious circle of "poverty - environmental problems" is being created, and the gap between rich and poor countries is widening. However, in economically developed countries, the relationship between environmental degradation, consumption levels and production structure is becoming increasingly clear. And all this does not meet the principles of sustainable development of society.

The process went so far that in 1987 the UN General Assembly raised the question of an alternative model of social development that, unlike the current model, would accept an environmental imperative and not based solely on the ideology of economic growth. The aforementioned Conference broadly defined the philosophy of development and the moral and ethical design of a new society of sustainable environmentally sound development.

In such a society, at the level of tradition, customary and legal law, balance must be maintained through the links between living beings with man, including the processes that take place in the suburbs: the change of seasons, the cycle of water, the growth of plants, and the like. The Sustainable Development Society is morally opposed to a society that sustains its life through short-term destructive exploitation of the natural environment. The unity of ethnos and natural

environment is a fundamental property of the biosphere. Breaking this unity always results in great loss for both the ethnos and the biosphere.

The unity of the social and the natural has long been the object of intense attention from the sciences that study nature and man. For Ukraine, this environmental and philosophical problem now arises in the practical plane: how to translate it into the language of our Ukrainian reality and everyday affairs.

In the United States, the problem of ethnic and environmental unity is now being considered within the framework of the new concept of bioregionalism [33]. By bioregionalism, the authors of this term understand everything related to long-term residence in one locality. Accordingly, bioregions are the natural habitats of every earthling. Living in one region for a long time, one looks for ways to ensure that they are organically involved in that region. This is an adaptation of a person to new conditions. In this case, it is important to recognize the significant difference in ecological, and therefore cultural, sense between the indigenous and the arrived ethnos. American scientist J. Farbs [35] thus characterizes this difference, referring to the local people (Indians) and Europeans who came to the continent: "The Aboriginal people of California felt a deep connection with each other and with other peoples, as well as with others their life forms, they felt the purity of the complex fabric of life, everything created and all things in the imagination of this people were brothers and sisters, so the basic principles of the existence of the Indians were the inability to exploit man by man and a deep respect for all living beings. circumstance the wines were tarnished by the integrity of California, in which 500 tribal republics had existed without conflict for 15,000 years. "

It should be noted that this fundamental incompatibility of the morality of aliens and natives made it impossible to transform them into slaves. The local people, under the force of coercion, went on the reservation, and the colonizers were forced to import slaves from other continents. Migrants from Europe, along with the achievements of their civilization, brought to the continent the destructive idea of the possibility of exploitation of man by man and nature by man. Recall that the modern moral crisis is a crisis of the attitude of man to man and man to nature.

Therefore, the current model of industrial-consumer society in the system is economy - nature is still oriented towards technological development (economic growth at any cost). This orientation causes a fundamental inability to properly protect the environment and to preserve natural resources from planned destructive technical pressure. That is why environmental measures are, for the most part, ineffective, and environmental legislation has proven ineffective.

The transition to sustainable development is first and foremost a change in the priorities of the economy-nature system: it is not about protecting the environment from an omnipotent economy, but about subordinating it to the environmental imperative - an urgent demand to obey the laws of nature and to understand and unequivocally accept the requirements and restrictions, defined by these laws in all spheres of social life. The current stage of human interaction with nature is characterized by a shift to ethical principles. It should be noted that a person can realize scientifically grounded behavior only when the humanization of relations with nature is sufficiently broad and ubiquitous. Preference will be given to nations in which moral and ethical principles operate both in culture, in collective consciousness and in historical experience, and ultimately, very importantly, will be enshrined in laws. It is this circumstance that determines the inequality of starting conditions of individual states on the way to a society of sustainable environmentally sound development.

The issue of human interaction with nature was first comprehensively and scientifically raised in 1969 by UN Secretary-General U. Tang. In his report at the UN General Meeting, the phenomena of the demographic avalanche, the depletion of natural resources and environmental pollution qualify as a global environmental catastrophe. W. Tan's historical report is an example of the first systematic approach to the problem of the coexistence of man and nature, which has since been viewed from the standpoint of the urgent requirement to live by the laws of nature and to take into account the restrictions they impose.

Since then, developed nations have quickly realized the threat to humanity and accepted the environmental imperative as the basis for economic development. Because of this, the modernization of the manufacturing sector has started on a global scale, which has had some positive effects that we see today with the example of countries such as the USA, Germany, Japan, France and others.

Governments of different countries and international organizations are increasingly recognizing the priority of the environmental imperative in addressing economic development.

However, it should be noted that attempts to solve environmental problems through the development and implementation of clean, resource- and energy-saving technologies are sufficient only to slow down negative environmental processes, but they are no longer able to stop them.

Today, environmental degradation continues on a global scale, natural resources are being depleted, accompanied by increased poverty, degradation of all spheres of public life, and loss of spiritual values.

Every year, six million hectares of arid, but productive land, turn into barren deserts, and eleven million hectares of forests disappear. Increasingly, there is a lack of quality drinking water and energy resources. Acid rains cause irreversible degradation of vast areas of fertile soil, destroy forests and ponds, and cause irreparable damage to human cultural monuments. Industry and agriculture add unacceptably large amounts of toxic substances to the food chain and respiratory processes. Due to the technogenic activity of humans, industrial emissions are released to such an extent that it causes a gradual warming of the planet's climate. The phenomenon of "greenhouse effect" in the near future can lead to an increase in average annual temperature, which will cause a significant increase in the level of the oceans. There will be a threat of flooding of coastal territories, which will negatively affect the economy of many countries. Harmful emissions into the atmosphere threaten the destruction of the planet's ozone layer, which can dramatically increase the number of cancers in humans and animals.

Particularly large problems of socio-economic development and related environmental problems exist now in the countries of the former USSR. This is especially true of Ukraine, where today the economic problems have most affected the state of the natural environment (terrestrial, air, water). Here, the so-called unified national economic complex played a devastating role in the development of the economy, giving it all the typical features of a colonial economy. As a result, the environment of our country, which occupied 2.7% of the territory of the USSR and had 2% of water resources, was particularly severely destroyed. The technological load here was 10-15 times more than in the USSR. It was in Ukraine that 40% of the Soviet Union's nuclear reactors were located; the plowed up of farmland, deforestation, polluted rivers, etc. were brought to a catastrophic level. Today, without exaggeration, it can be argued that there is an ecological crisis in Ukraine, which is destroying the nation's traditional livelihood system. This crisis is one of the main causes of degradation of Ukrainian society. In terms of standard of living, life expectancy and level of education (UN Development Index), Ukraine is now in the second hundred countries of the world, with 45 in 1994 and 94 in 1997. . Today, the death rate in Ukraine is much higher than the birth rate.

The relentless deepening of the ecological crisis, or more precisely, the crisis of society's relations with nature at the end of the 20th century, led to the need for radical changes in the development goals and priorities.

On this path, a special place belongs to the "Planetary Summit" (UN Conference) on Environment and Development ("RIO-92"), held in Rio de Janeiro in June 1992. The Summit declared the principles of a sustainable, environmentally friendly environment. two historic

documents were adopted and adopted: the "Declaration on the Environment and Development" and the "Global Agenda 21 - Agenda 21".

The leaders of 179 UN member states (Ukraine was represented at that summit by then-Verkhovna Rada Chairman I. Ivy) and 17,000 activists representing non-governmental organizations from all over the world called on governments of all countries and citizens of the Earth to implement sustainable environmental principles development in the field of social, economic and environmental policy.

The issue of sustainable green development was first raised by the World Commission on Environment and Development, headed by Swedish Prime Minister Mrs G. Brundtland (Commission Brundtland). The report of this commission, Our Common Future (1987), defines this concept: "Sustainable development is a development that meets the needs of the present generation without compromising the ability of the future generation to meet its own needs. "[93]. Since then, an active international activity has begun in the direction of comprehensively addressing environmental issues and raising the level of economy of all countries of the world.

There are many interpretations of the concept of sustainable questioning today, but none of them is widely recognized. It is possible that there will be no single interpretation of sustainable development, as there are quite different environmental, economic and social conditions in different countries. Each country should define its own policy in this direction. However, it is all about the development within the economic (ecological) capacity of the natural environment, which does not make irreversible changes in nature and does not create danger for any long-term existence of humans as a biological species of Homo Sapieps.

So, these are simple and obvious things - human well-being and the well-being of nature. The term "sustainable development" is associated with the concept of development balanced, stable, environmentally friendly.

Sustainable development society is a qualitatively new phase of post-industrial (post-economic) society. The concept of this society also means a new social order, which differs from the previous forms of the primary importance and role of the individual in the social structure and the natural environment. In the transition to a society of sustainable development, socio-economic progress should be not so much an increase in the volume of material goods produced, but in a change in the attitude of man to himself and his place in the world. However, this does not mean that the material security of the person loses value. On the contrary, material progress, an adequate level of material security is a prerequisite for the formation of a new socio-economic order. It is a sufficient condition for the formation of a new order with the change of human value priorities, the

creation of a situation when the main aspiration of the individual is the improvement of his inner, spiritual potential. Instead of labor as an activity dictated solely by material necessity, there must come activity, a motivated desire of man to reveal himself in accordance with his own inner nature.

The concept of sustainable development in the context of solving the problem of the global ecological crisis, of course, still needs comprehensive scientific, philosophical understanding, filling with deep economic, socio-cultural content, but already today this concept has become commonplace and is based on all contemporary considerations and ideas about the possible ways and nature of the future development of a particular society and the world community of states. It is about ending the reign of human monopoly in nature. There is no alternative to stall development. Ideas of sustainable environmental development will determine the outlook, moral, ecological, political, technological, humanitarian profiles of the 21st century.

The concept of sustainable development determines the new behavioral dominance of man in nature, which will determine its movement to the noosphere both today and in the long term.

The UN-RIO-92 Conference has developed common principles and recommendations for a balanced solution of socio-economic objectives and conservation of the natural environment and natural resource potential during the transition to sustainable development. It should be noted that sustainable development is not some fixed state of harmonious development, but rather a process of change, according to which the use of natural resources, directions of investment and technological development, institutional (political) transformations will be carried out on the basis of from both future and present needs. Sustainable development is a long-term, difficult evolutionary process. This is not just another campaign, not just a task, but a positive, hopeful desire for the future, a hope that we can be proud of the world that we will inherit for generations to come.

Based on these principles and recommendations, each country is expected to develop its own concept and strategy for environmentally sound development.

Most countries that have signed the Declaration of the UN Conference "RIO-92" have already identified their national concepts and strategies (Germany, USA, Japan, China, Russia, England, France, etc.). Moreover, Japan has already begun counting on its entry into a state of sustainable environmental development.

The nineteenth special session of the UN General Assembly in 1997 conducted a five-year review of the implementation of the decisions of the United Nations Conference on the Environment and Development ("RIO + 5"). The participants of the session expressed their concern about the worsening of the general tendencies of development since 1992. Unfortunately, the establishment of a strong regulatory framework and the developed principles of activity in the

direction of sustainable development did not provide rapid progress in this area. As the 19th Special Session of the UN General Assembly testified, progress on sustainable development is very slow. The session endorsed a document called the "Agenda for Further Implementation for the 21st Century", developed by the United Nations Sustainable Development Commission, which should help accelerate the implementation of the 21st Century Agenda. It was reaffirmed by the commitment of most countries to act in the spirit of the global partnership launched at the 1992 Earth Summit.

The culminating event in this area should be the World Sustainable Development Issue ("RIO + 10"), which took place in 2002 in Johannesburg, South Africa.

Unfortunately, the idea of sustainable development in Ukraine has not yet become a national priority, although in 1997 a National Commission for Sustainable Development of Ukraine was established under the Cabinet of Ministers of Ukraine under the chairmanship of the First Vice Prime Minister. The composition of this commission was updated in August 2000. However, this practically public body has never become an organizing and coordinating center for developing a consistent state policy for the implementation of sustainable development ideas.

However, since 1992 (from "RIO-92") the issue of sustainable development in Ukraine has to some extent been the subject of reflection, research and discussion by individual scholars, practitioners, and members of the public. However, this work is generally disordered and sometimes random.

The United Nations Development Program (UNDP in Ukraine) is focused on promoting sustainable development in Ukraine. The peculiarities of Ukraine's transition to sustainable development are first and foremost related to the need to address a set of environmental, social, and economic problems that are no longer relevant to developed countries.

In particular, despite all the well-known negative effects of development in an industrial (economic) society, developed countries have created one of the most important prerequisites for the transition to sustainable development - a material base that allows sufficient conditions for sustainable development to be fulfilled. The latter are first and foremost in the development of the individual, his or her self-improvement, the production of new knowledge, information that can change for the better not only the surrounding environment, but also, very importantly, each individual and society as a whole.

For Ukraine, the primary task is to halt degradation processes in nature and society. The next purely Ukrainian task is to take effective measures to "rehabilitate" the technogenically changed environment: to bring about the requirements of the environmental imperative of the structure of the

national economy; reducing to an ecologically sound level of plowing of agricultural lands; solution of the cascade of Dnieper reservoirs; restoration of soil fertility; solution of the problem of centralized water supply of settlements; increase of forested areas; recycling of household and industrial waste, etc.

It is important to realize that for Ukraine, the solution of humanitarian problems (educational, scientific, Ukrainian, cultural and scientific) is also a starting point for the development and implementation of effective environmentally-friendly technologies that will contribute to the development of the economy without destroying the the environment.

Ukraine's transition to a sustainable development society puts on the agenda the development and implementation of a new national environmental policy, both in the areas of nature, economy, technology and technology, as well as in the social and humanitarian spheres. Environmental policy is an integral part of the national security of the state.

It should be noted that the viability of the Ukrainian state in the future will depend more on the ability to mobilize internal resources (primarily natural and human) than on interaction with other states and political and economic blocs.

3.4. Basic principles of society transition to sustainable development

Sustainable development countries have made the following commitments [13,93]:

- to consider that the provision of mental development and preservation of human health is a priority task of life of every society;
- to determine a reasonable and sufficient limit to meet one's own material needs;
- accept that the average family has two children;
- adopt the concept of balanced development (eco-development);
- strive to protect the Earth's major ecosystems (natural areas, regions, localities);
- acquire knowledge of natural resource management;
- adopt the idea of an open economic system that functions on principles of sustainable environmentally sound development;
- adopt the principles of fair market trade;
- to tax economically developed countries to which the rigor of developing ones;
- coordinate (coordinate) national strategies for sustainable development programs and policies;

- to promote the development of citizens' rights and activity;

- to form international ecological structures.

Some of these principles are obvious (protect nature, families with two children, etc.). The deep content of others needs more careful consideration. The general humanitarian orientation of the principles, means and goals of sustainable development is noteworthy.

Promoting normal mental development and human health as the main task of the state. Ensuring normal mental development and maintaining human health is a major concern of every society. This is due to the global trend of progressive deterioration of the quality of the natural environment, on the one hand, and indirect (immune-reducing) and direct effects on the human body of an ecologically changed environment, on the other. Mentally ill people are organically incapable of building a sustainable society under any favorable circumstances. .

Factors that shape human health are averagely distributed as follows: lifestyle - 53, ecology - 21, biology (heredity) - 16, health care system - 10% [35].

According to the concept, the quality of life of citizens is the highest criterion for the efficiency of the state. Quality of life is not a parameterized concept yet. It is only obvious that this is a highly integrated characteristic (indicator) of the development of society. Its formation is influenced by many factors, which, in turn, are also highly integrated. Most often, the quality of life is determined by the level of consumption and the conditions in which it occurs (quality of the natural environment), which is perceived by the psycho-emotional sphere of a particular people.

Determining a reasonable limit to meeting a person's needs. The current model of production and consumption of industrialized countries is not environmentally oriented. In some countries, existing consumer standards may need to be modified. In particular, the US standard can by no means be a role model. The industrialized countries are using natural resources to such an extent and at a rate that poses a real threat to the biosphere. At the same time, there is a huge and ever-growing population of countries where natural resources are mostly sourced from hunger and poverty.

On this basis, it is necessary to focus on regional standards of consumption. For Ukraine it is possible to accept the Central European, which is considered "sufficient level of satisfaction of needs".

According to expert estimates, the consumption level of the modern average Ukrainian is about 20% of that of the average European. Therefore, Ukraine still has a significant reserve to increase consumption to meet the European standard by this parameter.

According to the recommendations of the Club of Rome, the average European level of consumption could be accepted as a world model. Adoption of such a standard would mean the prohibition and cessation of production and any pressure on the consumer by trade, manufacturers and advertising to increase consumption.

For highly developed countries, the question is: how should the economy of these countries develop if energy and raw materials are used without reducing their quality of life and quality. It is necessary to orient (teach) society to live so that, after reaching a certain level of consumption, society can focus on achievements in the intangible sphere. However, this position requires a completely different philosophy of life. Therefore, we must strive for the values of a sustainable development society to be perceived by each society and its members as personal.

Protection of the Earth's major ecosystems. In the environmental era, the attitude to the environment, which should be interpreted as a human home, must fundamentally change.

The problem of protecting the Earth's ecosystems consists of subproblems. Consider the most important of them.

Protection of the atmosphere. Human activity leads to the destruction of the ozone layer and climate change. Specific measures are proposed that are listed separately in the Climate Change Convention and in the Agenda for the 21st Century. Their implementation requires profound changes in many sectors of the economy, especially in the energy sector, transport, agro-industrial complex, forestry, etc.

These measures should stabilize industrial emissions as from 1990.

Specific measures for the conservation of the ozone layer, provided for by the Montreal Protocol of 1990, concern the limitation of industrial emissions, in particular freon, which destroys the ozone layer of the atmosphere. Particular attention was paid to air pollution by vehicle exhaust gases.

Protection of the water basin. In the interests of sustainable development, national strategies for integrated management of water resources, coastal zones and contaminated waste are expected to be developed.

To conserve natural marine ecosystems, it has been recognized as essential to develop marine biological resources; restore the number of endangered marine species; minimize the loss of fishing and effective control of fishing.

The main purpose of protecting freshwater ecosystems is to provide drinking water to populations across the globe. To this end, the principle of a multifaceted approach to managing freshwater resources on the planet should be introduced; continuous and continuous rational use of

water resources; introduction of water-saving and anhydrous technologies; integrated use of water resources with emphasis on the problem of wastewater disposal; formation of regional (basin, inter-basin) water and sanitation programs.

In urbanized areas, the supply of quality drinking water should be at the level of 40 liters per person per day, as well as a 75 percent minimum provision for urban residents with local sanitary and hygienic equipment. This means developing regional water management systems.

Desertion and xerizatz (increasing the dryness of the climate). In order to counteract the progressive desertification and increased xerisation, it is considered necessary to use appropriate soil protection methods against excessive evaporation of moisture; increase forested area; increase the area of vegetation; to ensure the livelihoods of the population in the desolate territories by improving the farming system; develop traditional folk strategies and systems of agriculture.

Forest protection. The general forest management principles adopted are binding on all. The main purpose of implementing these principles is to help manage forests (both natural and artificial) in all geographical and climatic zones.

Forest management is aimed at conserving forests in large areas based on the principle of continuity and continuity of forest existence. Forest resources provide material disposal for humans and maintain ecological balance on the planet.

The responsibility for managing, protecting and properly utilizing forests rests with individual states, regions and local governments. States have the sovereign right to exploit their forest resources in accordance with their economic policies.

The social significance of the forest is that the forest is a powerful stabilizer of the ecological regime in the biosphere, a biodiversity accumulator, a source of genetic material for biotechnology, and a means of meeting energy needs. The role of this energy source will increase as the area covered by the forest is increased and new plantations are created, including for special purposes.

Accordingly, forestry policy should be as focused as possible on the unconditional preservation of unique, environmentally important forests, including natural ones, and those of great cultural, spiritual, historical or religious importance.

A balanced industry policy requires complete and comprehensive information on forests and forest ecosystems. In the field of forestry, it is considered appropriate to develop international cooperation on the basis of international agreements, the development of appropriate organizational structures and mechanisms of cooperation. Trade in timber products must be conducted on a non-discriminatory basis and fully comply with international rules.

The international community must counteract the onslaught of predatory structures that exploit forest resources. Developing countries will receive financial support for forest regeneration. it should also be made available to the countries of Central and Eastern Europe with economies in transition.

Conservation of biological diversity. Biodiversity is the collection of all species of living organisms that form the terrestrial and aquatic ecosystems of the Earth.

The ecological significance of biodiversity is that each of the 1.8 million species occupies a specific ecological niche, that is, fulfills its inherent functions only in the biosphere. Every year, living organisms, through biogeochemical cycles, propel 480 billion tonnes of matter into the biosphere. As a result of photosynthesis, the biosphere gains enormous energy potential. Without this our planet would cease to exist. Environmental problems arise when a person disrupts the natural material or energy cycle in the biosphere or in a single ecosystem.

Under the International Convention on Biological Diversity, each state is responsible for the balanced use of its biological resources and the conservation of biodiversity. Balanced use of biological resources does not lead to their destruction or depletion.

The basis for biodiversity conservation is the protection of natural ecosystems and habitats and habitats, as well as the conservation of species in their natural environment.

The Convention provides for the following measures for the protection of biodiversity: monitoring of degradation processes; formation of a network of environmental objects; management of biological resources; protection of ecosystems from the penetration of alien species that threaten natural ecosystems; control over ge nontically modified organisms; developing rules for the protection and conservation of all types of organizations and ecosystems.

Highly developed countries have a responsibility to contribute to developing countries, in particular the countries of the South, which are characterized by high biodiversity and where genetic material for modern biotechnology is derived.

The Convention also establishes the principle of a fair and equitable sharing of the results of the study and the economic benefits of commercializing biological resources and genetic material. Developed States should provide for the development of additional sources of funding for developing countries' expenditures to cover the costs arising from the Convention.

Protection of mountain areas. Mountain areas are the main habitat for suburban ecosystems. This is the direct significance of mountain ecosystems. At the same time, in many cases, the nature of mountain systems has undergone significant changes under the influence of human activity. Modern mountain ecosystems are a mosaic of natural and altered ecosystems.

It is necessary to create a data bank in order to develop a systematic approach to the problem of mountain area management. In particular, it is proposed to adopt such integrated programs for mountain areas and ecosystems: development of a hydrographic network; erosion protection; improving the sustainability and productivity of natural ecosystems; development of ecological tourism.

Development of knowledge about natural resources management. In the transition to a sustainable development society, natural resource management training is a leading direction. Such processes from the era of scientific and technological progress as the subjugation of nature, the intensification of the use of natural resources, and so forth, should as soon as possible go to the historical past.

Replacing profit policy at any cost should come from an economist who has embraced the environmental imperative and is focused on balanced management of Earth's resources.

Land Management. Comprehensive programs need to be developed to ensure the most efficient use of land resources from an environmental point of view. Territorial and local communities need to be involved in the land reform. This also applies to industries whose operation is related to significant terrestrial changes (mining, water, agriculture, etc.).

For balanced development, it is extremely important to develop a naturalistic strategy for rural development, the agro-industrial complex as a whole. It is envisaged to create conditions for the development of areas not directly related to agro-culture (folk crafts, aquatic cultures, fisheries, recreation, tourism, etc.).

Industrial and household waste management. An avalanche-like increase in the amount of industrial and household waste requires urgent action: minimizing waste; integrated waste management (recycling); promoting the development of biological wastewater treatment methods; waste management and more.

Management of toxic chemical materials. A prerequisite for sustainable development is to ensure the safety of the population with respect to the chemical factor. To this end, the International Chemical Security Program (IP88) was adopted.

Chemicals are traded outside international control, so programs need to be developed to assess the risks associated with chemical management. To ensure safety in the transportation of toxic and reactive materials, an international chemical safety map has an important role to play. The solution to this problem is hampered by the lack of a harmonized classification of threats and a unified system of labeling of chemical materials. In this area, harmful substances should be replaced

with less harmful or completely harmless ones; establish mechanisms to prevent pollution; promote the development of clean industries and technologies.

Methods for detecting transboundary movements of harmful chemical materials should also be improved.

Management of radioactive waste. The risk of accumulation of radioactive waste produced in man-made production processes is constantly increasing. In order to overcome or at least curb this negative phenomenon, it is envisaged to take the following priority measures: to prohibit the storage of high, medium and low level radioactivity near the seas (London Convention); prohibit the export of radioactive waste to countries that prohibit the import of such waste (based on the Bamako, Lome Convention, etc.).

Adoption of the open economic system concept. In order to realize the principles of a sustainable development society, it is necessary to have a different economic system. The current economic system is first and foremost aimed at maximizing profit at any cost. This leads to the formation of relationships that do not meet the declared principles of sustainable development. The economic mechanism of these relations is such that the poor participant in the international economic process is poorer and the rich are rich.

The notion of "partnership" and "fairness" should replace the claim criterion. Partnership is a relationship where the stronger cares for the weaker and not presses with all means, as happens between countries that call themselves strategic partners. Adopting this principle would mean a profound restructuring of the whole philosophy of the free market economy. The economy of costs would cease to be the main mechanism of the market and the engine of the market economy. We need an economy that is acceptable to all, including the so-called strategic partners. This is one of the most difficult tasks without which the transition to sustainable development will not occur. The introduction of new principles of interstate relations will only be possible when the overall level of environmental awareness in the world is significantly increased.

The most important task of the new economic system is the complete abandonment of unbalanced production systems. Systems, in particular environmental, with unbalanced energy or material cycles, are unstable, degrading and decomposing.

Adoption of a Fair Trade Principle. The condition of a partner economic system is the introduction of fair trade. The mandatory free trade principle in practice often leads to spontaneous discrimination against weak partners. This is especially true for developing countries and countries with so-called transitional economies. In order to protect the interests of these countries, new rules of the game should be adopted, namely: a well-established, fair, secure, non-discriminatory and

promising trading system; optimal distribution of world products and obtaining comparable profits of the countries participating in the economic process.

Third world countries have developed a scale of losses that they suffer through unfair trade with developed countries. This is a significant amount - $ 125 billion. US annually.

The principle of fair trade requires the inclusion of an environmental component in the value of the product. Low oil prices inhibit the development of unconventional energy sources (wind, water, sun, etc.).

The cost of each product must include the pure product quota and the cost of the product. In this way, you can promote genuine entrepreneurship in accordance with the declared principles. At the same time, technologies and products that are not environmentally friendly should be removed.

Taxation of industrialized countries in favor of developing countries. The UN-RIO-92 conference has created two financial mechanisms to support the new socio-economic environment. Developed countries commit to allocating 0.7% of their gross national income (gross) to developing countries (Official Development Assistance (ODA)). An appropriate fund has been set up for this purpose.

Only four small North European countries (Sweden, the Netherlands, Denmark and Norway) have reached these figures; the rest of the developed world spends less than 0.35% of its GDP on these goals. Thus, in 1998, the US allocated 0.1%, Japan - 0.28, Canada - 0.29, Germany - 0.26%. Unfortunately, since 1996, ODA volumes have been steadily declining.

It is envisaged that the following structures and activities will be used to fund individual programs in the 21st Century agenda.

- International Development Fund (Ipegpaioiopai Oeeuiortepi: Aepsu);
- International Environmental Fund established by the World Bank (UNDP and UNED);
- UN specialized agencies;
- versatile assistance programs;
- private sources;
- various forms of debt freezing;
- economic incentives and taxation mechanisms;
- simplification of obtaining trade permits;
- conversion of the military-industrial complex.

The principles of funding sources are determined by the relevant UN bodies.

Formation of national environmental policies. Countries that have joined the decisions of the UN Conference "RIO-92" have a responsibility to adopt national sustainable development strategies by 2002.

States' environmental policies should facilitate the development of appropriate procedures for reconciling environmental requirements and development strategies.

In the interests of the environment, cross-sectoral coordination and cooperation are indispensable. Sustainable development requires strong government policies and dynamic support within international economic cooperation.

In 1997, the Secretary-General of the United Nations presented to the UN sessions the results obtained by the world community in the framework of the implementation of the Agenda for the 21st Century. Unfortunately, these results did not meet expectations.

Development of citizens' rights and activity. One of the basic principles of implementing the Concept of Sustainable Environmental Development is to involve the public in policy-making and decision-making. Non-governmental organizations play an important role in this process. It was envisaged that by 1995 the preconditions for dialogue between governments and the public would be created. This partnership involves the involvement of non-governmental organizations in reviewing and evaluating the implementation of the Agape-21 document at all stages and levels.

Regional (local) self-government bodies have the greatest influence on the formation of economic and social infrastructure insofar as it relates to the environment. They influence planning processes and form local prescriptions in the field of nature protection. The local government maintains public relations in nature. It was envisaged that by 1998, local action programs would be developed in agreement with local communities (in Ukraine, this was the formulation of regional and district environmental policy), involving trade unions, in particular large industrial enterprises. Given the environmental status of the Ukrainian agroindustrial complex, it is extremely important for peasants to participate in the formation of rural and agricultural development strategies in the context of sustainable development.

In this respect, it is also important to implement the Nairobi Conference's decision to expand the role and participation of women in all areas of social life (gender policy).

The activities of public organizations and individuals are based on the principle No. 11 of the Declaration "RIO-92", according to which "... every person should have guaranteed access to environmental information available to the environment. Public authority. " This means that individuals, groups and organizations should be able to access environmental information on the

state of the environment, as well as information on all decisions and activities planned. In this context, the provisions of the Aarhus Convention need to be implemented.

Formation of new pro-ecological organizational structures. According to the recommendations of the RIO-92 Conference, the role and functions of the UN in environmental and development issues should be strengthened. Sustainable Sustainable Development Commissions should be set up, consisting of representatives of all states with a uniform representation of geographical regions. The working conditions of this Commission are determined by the 47th session of the United Nations.

The Permanent Commission on Sustainable Development is called upon to oversee the implementation of the principles and measures provided for in the Agenda for the 21st Century; to review information on the activities of individual structures; involvement of public organizations.

The role of UNEP and its management is expected to be further strengthened. The UNEP Board in the field of environmental policy coordination has a particular focus on development prospects. This implies strengthening UNEP regional structures, establishing a center in Nairobi and so on. The implementation of Agenda 21 should be supported by UNDP structures. Individual states must decide on the establishment of their structures responsible for the implementation of national programs.

In this context, it has been recognized as necessary to form a Earth Council.

In the future, it is envisaged to consider the establishment of the World Ecological Federation - the UN legislative and regulatory body; adoption of the international environmental constitution - the main legal document; the formation of the International Ecological Police in order to comply with the International Ecological Constitution; the establishment of an International Environmental Tribunal which would rule on environmental crimes; the establishment of the International Environmental Bank to finance the activities of established environmental structures.

Logically, these principles should be the basis for developing both a concept and a strategy for sustainable ecologically sound development of Ukraine, taking into account its peculiarities and problems.

3.5 Indicators of sustainable development

The transition to a sustainable development society is associated with purposeful, linguistic changes in the social and economic spheres, improvement of the environment, which ultimately has a positive impact on the quality of life of society in general and of each individual in particular.

3.5 Indicators of sustainable development

Sustainable development indicators are of the utmost importance for the actual planning of such development, the conduct of appropriate monitoring studies, the development of mechanisms to achieve this goal, and the adoption of effective management decisions.

They are quantitative or qualitative characteristics of socio-economic processes, environmental conditions and quality of life and can be used to assess the compliance of a complex natural-socio-economic system with the principles of sustainable development.

At the same time, one of the main tasks for the targeted use of sustainable development indicators is to establish their normative (standard) values. Examples of such regulatory indicators are environmentally sound maximum permissible concentrations (MPCs), established DSTUs, SNIPs and various known instructions for assessing the state of environmental pollution. Without sustainable development indicators, it is impossible to develop a sustainable development strategy, and even more so a coherent program of action and benchmarking in a particular country or region.

Using the conditions and mechanisms for achieving regulatory indicators and comparing different options for economic activity in a particular territory, you can get the most appropriate option for such activities, which is consistent with the strategy of sustainable development.

Documents "RY-92" emphasize the need to develop such indicators. This issue is the focus of the UN Commission on Sustainable Development. The working group of this commission to monitor the process of sustainable development has proposed a key group of indicators that can vary at the individual state level, taking into account the specific political, social, economic, environmental situation and historical national experience.

The identified indicators of the key group are divided into subgroups and in accordance with economic, social, national, institutional and environmental components of sustainable development. These indicators are presented in the system "driving forces - position - consequences". This system is adopted by the analogy of environmental indicators "pressure - state - reaction" and is intended for the analysis of dynamic changes of the process of transition to sustainable development in a two or three - dimensional coordinate system.

Indicators of "driving forces" mean activities and processes that affect sustainable development; indicators of "position" and correspond to the realities (state, stage) of sustainable development; the "impact" indicators indicate the nature of changes due to changes in "stance". A total of 134 indicators were compiled, 125 of them methodologically substantiated.

Indicators in the specified system were developed taking into account the following criteria:

- possibility to use them primarily at regional and national levels;
- compliance of the indicator with the purpose of application;

- the indicators should be simple, convenient and consistent;

- the indicators must be real for practical application based on their technological and other capabilities of the states,

- the number of indicators should be limited, but if necessary

can be increased;

- indicators should cover all components of sustainable development

(environmental, economic and social);

- indicators should take into account existing international agreements;

- information on indicators should not be too complicated, the costs should be justified in terms of benefits.

As noted, the key metric can be modified and expanded by introducing new metrics. At the same time, there are certain potentially important indicators that require further methodological justification for practical application. In particular, this applies to indicators that characterize ecosystems, including biodiversity, the development of science, education, technology, management systems, hazardous wastes, desertification of territories, development of mountain areas, etc.

Voluntary testing of the proposed key group indicators was conducted in 21 countries. At the same time, it turned out that the set of indicators for use at the national level is not sufficient, definitive and unchanged. Each country must determine to what extent the set of indicators proposed corresponds to its national characteristics, priorities and objectives. It has been confirmed that the development and implementation of both a scorecard and sustainable development strategies, monitoring these processes in each country should not be a matter for ministries and agencies alone, as this greatly limits the ability to address the needs of many social groups. Involvement of non-governmental organizations, the private sector, trade unions, women's and youth organizations, indigenous peoples and nationalities is a necessary component of developing strategies and developing indicators at the national level. It was recognized that in each country institutions should be created to bring together these groups to make decisions and formulate national mechanisms for developing and implementing a system of sustainable development indicators and harmonizing them at national, regional and global levels.

As of October 2000, some of the RIO-92 participating countries have posted on the Internet reports on the results of the testing of indicators proposed by the UN.

The analysis of the cases of development and implementation in practice of indicators of sustainable development in different countries convinces that for their determination and

methodological justification in some countries, including in Ukraine, a painstaking scientific and practical work is required. Particular difficulties are associated with the need to create a hierarchical structure of a system of indicators, the summit of which would be one indicator of quality of life, aggregated from indicators of material security and environmental quality. Higher-level metrics should be integral to lower-level metrics of varying nature and functionally often unrelated.

An example of such an integrated indicator of social orientation is the "human development index" used by the UN to benchmark the level of social development in the world. This indicator is based on three sociometric values: national income per capita (standard of living), average life expectancy and average life expectancy of the population (level of education). From the analysis of the essence of the "human development index" it follows that this indicator, although based on the three, perhaps the most important, values, in the context of sustainable development, cannot answer the questions about the various factors that shape these values.

In order to move Ukraine towards sustainable development as soon as possible, it is necessary to create a sound system of indicators of sustainable development of different levels of their aggregation. Methodologically, this is an extremely difficult task that can only be successfully handled by professionals through a comprehensive interdisciplinary study.

In this context, noteworthy attention is drawn to the elaboration of the scientists of the Council for the Study of Productive Forces of Ukraine of the NAS of Ukraine under the guidance of NAS Corresponding Member SI Doroguntsov, who initiated the comprehension and quantification of indicators of sustainable development of Ukraine [93].

3.6 Environmental laws

The transition to a sustainable development society requires the establishment and persistent application of laws and rules that operate in an environment that is objectively inclusive and operate independently of the will of the individual. Such laws of Nature include environmental laws that operate at all levels of environmental organization - from the organism to human society and the biosphere, inclusive [35,93].

1. The law of boomerang, or feedback, in the human-biosphere relationship (B. Commoner): any interference with natural systems causes a chain of change, usually unexpected and unwanted.

2. The law of limitation of exploitation (transformation) of natural systems: rational and productive implementation of economic projects is possible only within certain limits (zones of optimum), the way out of which leads to environmental and socio-economic losses; it cannot take

more from the environment than it can give, and it should take less; human activity should not lead to a disturbance of the dynamic equilibrium in nature, and any disturbances should be compensated.

3. The law of diminishing returns (T. Malthus): energy investment in agroeco-

the system does not provide a proportional increase in the performance of these systems; the ratio of energy consumption in agriculture and energy obtained in the form of crops in the United States in 1910 was 1: 1, and since the 70's of XX century. - 10: 1; in the former USSR this ratio was 30: 1.

4. The law of joint action is a factor or the law of synergism (E. Mitschllich): the interaction of a set of factors in the system is increased in comparison with the independent influence of each factor individually.

5. The law of limitation of natural resources: natural resource

potential in the process of the historical progress of mankind is depleted.

6. Law of irreplaceability of environmental factors: one environmental

the factor cannot be replaced without harming the ecosystem.

7. The Law of the Distant Perspective (B. Ehrlich): the most dangerous for

all living things are the notion that only the immediate goals and needs of a person should be taken into account and the distant perspective should not be taken into account.

8. The law of cycling (cyclicity) (V. Williams): to give the child the properties of inexhaustibility (infinity), it is necessary to make it rotate in a closed curve. In this way, high productivity and stability of natural ecosystems are observed with limited stocks of mobile forms of plant mineral nutrients. This law is based on the phenomenon of cyclicality. It is assumed that the society of sustainable environmentally sound development will be predominantly based on the principle of cyclic (repeated) use of raw materials.

9. The law of the "pyramid of numbers": from the lower level of the ecological pyramid to the highest, in the most favorable circumstances, no more than 10% of the energy received by the living creatures of the lower level is transferred. This law allows to determine the maximum demographic capacity of the Earth and to design models of the most appropriate ecosystems.

19. Law of interaction between society and nature (S. Podolynsky): the stability of development can be ensured only when the vital activity of society is consistent with the capabilities of the whole-evolutionary biosphere process, which consists in the creation of additional energy on Earth by means of photosynthesis. Due to this energy, other subsystems of society (technology, economy, culture, education, construction, etc.) are developing.

20. Law of limiting factor (Yu. Liebig): the maximum productivity (efficiency) of a multifactor system is determined by a factor that is at a minimum. For the sake of clarity, this law is illustrated by a tub of water with different height of rivets (factors). The maximum water level in the tub according to the law of the limiting factor will be determined by the height of the smallest riveting. That is why this law is sometimes called the "least riveting" law. Proper and timely determination of the limiting factor is extremely important for making sound projections (environmental, economic, social, technical, etc.).

21. Malthus Law ("Malthusian Trap") ', growth rate

population significantly exceeds the growth rate of livelihoods. When the population begins to outweigh the livelihoods, factors of preventive population restriction (later marriages, moral, religious and administrative bans, etc.), and on the other, regulating the effects of famine, disease, war, and so on, are taking effect.

22. The Golden Praxeological Rule (T. Kotarbinsky): Every good thing that is started within a vicious system is sooner or later neutralized by this system. A clear illustration of the operation of this rule is all previous attempts to build a democratic, fair, legal, economically developed and socially oriented state in Ukraine.

It is clear that without the scientific application of these rules in practice, it is impossible to realize the concept of sustainable development of society.

4 ECO-ECONOMIC TRAINING AND EDUCATION IN THE SECONDARY SCHOOL

The contradictions of the relationship between human society and nature are based on the need for constant human intervention in the course of natural processes, intensive development of natural resources, the inability to keep nature intact. Therefore, education has an important educational and educational task - to prepare the young generation of people who will be able to optimize the relationship between society and nature, to preserve the beauty of the environment, to ensure self-regulation in the natural environment [36,110]. The goal of environmental education is to educate people about their responsibility for protecting and improving the environment. so that their actions do not contradict established standards, that they take the initiative and participate in environmental activities, promote the efforts of society to solve environmental problems at all levels. Environmental education is understood as a continuous process of education, upbringing and development aimed at shaping environmental culture. Environmental responsibility of every person on our planet. Problems of environmental education and upbringing are expanding national boundaries and are becoming increasingly international.

In developed countries various programs and concepts of development of ecological education, programs and plans of training of specialists of ecologists of modern level are developed and improved. In the last few years, many textbooks, textbooks, non-fiction and non-fiction books have been published, films have been made and recommendations for ecological and educational content have been developed. In most countries of the world ecology has become a compulsory discipline in all schools and higher educational establishments, in many higher educational establishments the departments or faculties of ecological profile have been created, hundreds of ecological national and international seminars, conferences, congresses have been held.

A large amount of ecological and educational work is carried out all over the world by the organizations of "green", nature protection societies, among them such known as "Greenpeace", "Legambbiente" and others.

These processes of ecologization of population consciousness, formation of a new - ecological worldview, new - ecological culture are quite characteristic for Ukraine as well.

Over the past five years, programs and concepts for the development of environmental education and training have been developed in our country, manuals and textbooks on ecology have been published, dozens of departments and faculties of environmental profile have been created in institutes and universities, many journals of environmental, environmental, economic, ecological-

geographical content ("Oykumena", "World in the palms", "Snowdrop", "Sprout", "Native nature", etc.).

As early as 1975, participants in the International Seminar on Environmental Education (Belgrade, Yugoslavia) proposed a global eco-education scheme. According to this scheme, the main objective of environmental education should be to create in the planet's population an awareness of the emergence of a vital global environmental problem and of everything associated with it, an awareness that the environment needs to be cared for and that it needs to be properly addressed. knowledge, experience, skills, motivations and commitments, both individually and collectively, to save the biosphere and prevent future environmental catastrophes.

In 1977, at the International Conference (Tbilisi), the objectives and goals of environmental education were specified:

- to promote a clear awareness that society is developing through the close interconnections of all natural and social processes;

- to provide each person with the opportunity to acquire the knowledge, law, experience and conditions of their implementation necessary for environmental protection and improvement;

- Develop new algorithms for the behavior of the individual, groups of people and society as a whole in relation to the environment.

Today, formal environmental education (in schools, universities, advanced training institutes) and non-formal education (through mass media, cinemas, museums, exhibitions, environmental events, etc.) are actively developing.

Of particular importance to the development of environmental education and culture around the world in recent years, when it became apparent that one of the main reasons for failure to comply with the decisions of international environmental fora, agreements and conventions on nature conservation is the low environmental culture of the majority of the planet's population, and the low level of environmental education. and consciousness, including those who make important decisions. Therefore, from 1997 to 2003, many international assemblies actively discussed the problems of environmental education and upbringing and their role in the environmentally-balanced development of humanity (New Delhi, 1997; Paris, 1998; Zurich, 1999; Brussels, 1999; Dakar, 2000; Johannesburg, 2002 and others).

In 2002, the Ministry of Education and Science of Sweden, together with the Ministry of the Environment of that country, on the task of the European Economic Commission 00H, developed the project "Education Strategies for Ecological-Balanced Development and Environmental Education ECE 00N". In 2003, special workers ECE 00N groups laid down the theoretical

foundations of a strategy for education for sustainable development and outlined ways of its implementation.

Throughout the world, such concepts as "environmental philosophy of life", "environmental priorities", "environmental imperative", "environmental paradigm" (a system of values, approaches, principles) are spreading. These concepts are justified and used in the environmental education system.

Today in the world, environmental education is recognized as one of the main factors in the greening of all human activities. It is seen as an independent and urgent problem, as an important management tool, the main lever for improving the production and consumption model in the light of capabilities biosphere.

The period from 2005 to 2015 at the World Summit in Johannesburg is recommended to be a decade of education for eco-balanced development.

During this same period, a number of important events related to the development of environmental education also took place in Ukraine: in late 2001 the Concept of Environmental Education of Ukraine was approved, in early 2002 - a plan of measures for its implementation, in late 2002, submitted to the Verkhovna Rada the draft Law of Ukraine on environmental education.

In 2001, the first specialized higher education institution was created in our country - Odessa State Ecological University, the basic training for the Ministry of Ecology and Natural Resources of Ukraine.

A conscious and caring attitude towards nature should be formed from childhood, in the family, at school, and is possible only if the general ecological culture is formed, and theoretical and practical knowledge in this field is accumulated. Society today must draw a line to eradicate the psychology of the inexhaustibility of natural resources and consumer attitudes toward nature in all its members. The effectiveness of ecological education depends first and foremost on providing a well-thought-out complex system in its implementation, on widespread familiarization of students with all the basic aspects of nature protection: natural-scientific, economic, health-hygienic, moral-ethical and scientific-cognitive [49].

Ecological education and training is a psychological and pedagogical process aimed at the formation of a person's knowledge of the scientific bases of nature management, the necessary beliefs and practical skills, a certain orientation and an active life position in the field of protection of natural resources. The objectives of environmental education include [44-46]:

- assimilation of scientific knowledge about the interconnection of nature, society and human activity;

- understanding the multifaceted value of nature for society as a whole

and each person in particular;

- mastering the rules of proper behavior in the natural environment

higher;

- development of the need for communication with nature;

- intensification of activities for the protection and improvement of the environment

environment.

Preschool environmental education should be aimed at instilling love for the Motherland and native land, learning about the concept of life and death, developing the skills of caring attitude to the environment of living and inanimate nature, the desire to preserve flora and fauna, to make the environment better.

A comprehensive school is designed to educate students in a spirit of love for their native nature, environmental protection, the scientific-based use of its wealth and potential. In schools, the environmental education of students is carried out in different directions: in lessons, classes, during excursions, in the process of socially useful work, during research and so on. Environmental education is not a teacher of one subject, it is a multifaceted job. it should be implemented in a comprehensive manner with the participation of elementary and elementary teachers. On the other hand, environmental education should be carried out not only in the classroom, in the extracurricular work, in the system of self-study, and should have not only applied but also cognitive and research character. it is advisable to include it in the national system of nature conservation measures and to coordinate with relevant scientific institutions with appropriate methodological, material and personnel support.

At school, the system of environmental knowledge must be revealed when studying all subjects. All types of socially useful and productive work must be environmentally friendly. Environmental work at school should meet the goals of humanistic education, promote the development of environmental rules and standards of behavior in the environment. Ecological education should be continuous and carried out during preschool, school, student and postgraduate educational periods.

4.1 Environmental education of elementary school students

In analyzing the prospects of national economy development in the lessons of geography, physics, chemistry, biology, it is necessary to acquaint students with the basics of waste-free technologies, which are aimed at the implementation of ecological principles, and first of all - the principle of natural metabolism, they should always be led to believe that it is only through the implementation of scientific advances that the use of the latest technologies in all fields of production can reduce emissions of harmful substances into the environment.

In the formation of environmental consciousness responsible role belongs to primary school, which is one of the first links of becoming a human citizen. The main personality traits are formed in early childhood, and communication with nature is of paramount importance in the upbringing of the child. For the successful ecological education of younger students, it is necessary to identify the ecological potential of each subject, the main role in this should be given to science, in the study of which should lay the scientific basis of children's environmental activity. A special place in ecological education should take the course "Familiarity with the outside world", in the study of which children get acquainted with the environment. In this course, the main thing is to begin to form a holistic view of the natural and social environment, to develop correct behavior in the team and nature. In the study of science, younger students should learn about the relationship and interplay of living and inanimate nature, nature and production activities of people.

Already in elementary school children should be led to believe that man is an integral part of nature, that it is developing, by meeting its needs, influences the environment. Moreover, this influence can be both positive and very negative. It is advisable to give examples of natural science lessons and show that predatory nature has destroyed large areas of forests, reducing the numbers of many animals, birds and plants, many of which have completely disappeared from the Earth's surface.

As the most accessible for younger students is the emotional and aesthetic perception of the natural environment, the teacher needs to find ways to merge emotional feelings in relation to nature with cognitive tasks for its study and practical actions for protection. A very active form of organization of environmental activity of students of grades 1-4 is excursions, during which they form positive attitudes, observational skills, orientation to the positive them and negative phenomena in the natural environment, emotional and aesthetic perception of responsibility for its condition. During seasonal excursions into the nature, focusing the attention of children on the characteristics of each season, it is advisable to form a sense of cross, love for the native land, skills

of competent behavior in nature, assessment of positive and negative actions of the person in relation to the environment [42 , 87].

A rational attitude to nature is formed when the child directly influences the environment through his or her hard work. In the course of their work, children need to supplement and deepen their knowledge, while developing the practical skills needed to make wise use of natural resources. The first step of engaging children in environmental work is to create an appropriate classroom environment: properly selected and placed plants, appropriate tables, herbarium, collections, and more. Later - direct involvement of students in environmental matters: feeding birds in winter, planting trees, flowers in spring, pruning, grooming, participating in the work of the "green patrol" and more.

The nature of conservation work must meet the goals of humanistic education - students do not need to focus on the anti-scientific division of animals into useful and harmful, necessary and unnecessary plants. The teacher's task is to nurture a caring attitude to any animal and plant. Children should learn that during walks, excursions, hikes, they cannot tear flowers, break tree branches and bushes, destroy bird nests, ants, pollute the environment, pick up baby animals and chicks.

Homework should also be subordinated to environmental work and its humanistic nature. In addition, they must be creative - include practical work, elements of observation, modeling, logical conclusions. For example, students produce a herbarium of flowering plants, harvest and paste leaves of native trees and shrubs, fill tables in exercise books, draw up schemes, produce sketches. At the same time, it is advisable to focus their attention on the role and place of the studied objects in nature and human life. Important »is homework related to simple experiments: the transition of water from a liquid state to a solid or gaseous, measuring the temperature of various substances (water, air, etc.), seed germination, plant cultivation, observation in their development.

Out-of-class student work is important in studying science. It may include the work of students in a corner of wildlife, in a study area, on a geographical site, or directly in nature - in a forest, field or garden. During such work; students need to be taught not only to observe the phenomena in nature, to do some work, but also to describe them in detail, paying attention to certain features, highlighting patterns and unexpected results. Particular attention should be paid to the ability to draw conclusions about the work and the results obtained.

4.2 Polytechnic content of environmental education

The idea of optimizing the relationship of human society with the natural can be very well disclosed in a specific material in the study of natural disciplines. The natural sciences create the necessary theoretical basis for the development of the students of the overall holistic picture of the world with the unity and diversity of connections between living and inanimate nature. I study physical, chemical, biological laws, phenomena and processes, modern industrial and agricultural production, the students get knowledge about the permissible anthropogenic load on the environment and about possible permissible changes in it. The main point is to understand that society, by receiving matter, energy, information from nature, causes harm to it, which cannot exceed a certain boundary, beyond which non-return changes occur and later environmental disasters. From the point of view of optimization of interaction between society and nature, the basics of production should be studied at school: rational use of natural resources of both mineral and biological origin (extraction, storage, transportation), principles of socially harmless technologies, work of technical complexes and systems for protection environment from pollution. Polytechnic education should be directed at understanding the process of "humanization of technology", the transition from the ideal of the conqueror of nature, who puts all the forces of nature to service, to the new ideal of man who wants to maintain biological equilibrium and who understands that it is part of nature, and their fates are interconnected and interdependent. This approach requires not only the acquisition of the skills of efficient production activity, but also the education of a sense of responsibility for its consequences. In this regard, it is necessary to talk about the students learn about the ecological culture of production and industrial relations in the process of studying all subjects.

Environmental knowledge of the natural cycle includes knowledge about environmental protection from industrial and household pollution. waste. Atmospheric pollution today is one of the most important factors limiting human life and activities. The threat of pollution is particularly high when industrial wastes released into the biosphere interact with its components and accumulate in its systems, changing the chemical composition and physical state of the atmosphere, soil and water. Man, as a biological object, undergoes a great impact - deteriorating health, decreases the efficiency of production activities, increases mortality. The school aims to form in the younger generation the quality of economical owners in relation to nature, to introduce students in practice with such concepts as "modern environmental problems", "man and environment", "food problem", "energy and raw material crises", "trends in development of society ", that is, with elements of environmental education and culture [45].

4.2.1 In biology lessons

The value of the school biology course in environmental education is determined, first and foremost, by the content of scientific knowledge about living systems at different levels. Particular attention should be paid to the above-organismal levels of organization: populations of species, society (biocenoses), biogeocenoses (ecosystems) and the biosphere as a whole. In accordance with the program, the student receives knowledge of biological systems at all levels of life organization. In botany - about organisms, flora, species abundance. In the course of zoology plants, animals, fungi, microorganisms are studied. The value of this knowledge is determined by the fact that they reveal the multistage nature of the organization of the living, where each sprout is a system that has its own special properties that differ from those of its constituent elements. Thus, population properties - sustainable reproduction and evolution - do not boil down to the properties of individuals characterized by ontogeny; the regular change of group properties cannot be reduced to the properties of populations of the species that make up this group [46].

Only at the level of the biosphere is there a global metabolism that cannot occur at ecosystems of a different rank. In ecology, this phenomenon is called the principle of functional integration. His knowledge is twofold. On this basis, students become familiar with the manifestation of such patterns as the transition of quantity into quality. In addition, this principle is of practical importance, since it implies the need to maintain the integrity of the biosphere and all its subsystems.

In biology lessons, you can clearly show how any natural biogeocenosis works. At the entrance - solar energy, mineral elements, atmosphere, groundwater. There are usually several system exits. In essence, energy and biogenic matter are emitted everywhere, but heat, oxygen, carbon dioxide and some other gases are released into the atmosphere of biogeocenosis; in the lithosphere - humic compounds, minerals; in the hydrosphere - solutions of biogenic substances in soil, river and other waters.

Large biosphere exchange consists of processes connected with one another - biogeochemical cycles of carbon, water, nitrogen, phosphorus, sulfur, biogenic cations - calcium, potassium, sodium, iron, copper and others. The exchange of oxygen and carbon is of vital importance for all organisms.

Abiotic environment, the properties of which are comprehensively studied in the courses of physical geography, physics, chemistry, in biology are viewed from a different angle - not in itself,

but in connection with living organisms, in interaction. Interactions of organisms are manifested through various types of adaptations (morphologically, anatomically, biochemically), and from the environment - in changing its parameters under the action of organisms (formation of microclimate, gas composition of the atmosphere, mechanical properties and chemical composition of soil, etc.).

The study of the abiotic environment allows students to characterize the dynamics of environmental change. Students are introduced to relatively constant factors over long periods of time (gravity, atmospheric properties, ocean water composition, etc.) in relation to factors in space and time (temperature, humidity, wind, etc.), with regularly and irregularly time-varying factors (rhythms of ebb and flow, natural disasters, storms, floods, floods, etc.), directionality over certain periods of time - warming and cooling of the climate, overgrown reservoirs, afforestation and pastures etc.

In biology lessons, students learn about evolutionary theory, which not only serves as a tool of knowledge in human hands, but also allows us to optimize the relationship between society and nature. Having mastered the theory of natural selection, the student can understand and explain the phenomena of the destruction of some organisms that were not intended to destroy, and the emergence of other species resistant to, for example, pesticides and poison chemicals. Studying the evolutionary theory and development of the organic world, the student becomes convinced of the nature-forming function of living matter, the functions of the living manifest themselves in such important for human life processes as the metabolism and energy flow, an important consequence of which is the self-purification of the biosphere as a whole and its subsystems 56].

In the course of biology, ecological knowledge should be closely linked to the economic and social aspects of ecology. In this case, the task of value orientation of students, understanding of the value of nature for society and each person will be realized. The specificity of this approach is the study of environmental problems in relation to human activities. It should be emphasized that human needs and goals are not always aimed at preserving natural bonds. Man, when solving certain tasks, often receives unexpected results that have a negative impact on society and nature as a whole.

An important element of environmental education in the lessons of biology is the awareness of students with the impact of the development of recreation and recreational activities as a special anthropogenic factor. In students, and in fact, in the adult population, the use of nature for recreation, as a rule, does not cause associations with the obvious threat to ecosystems. At the same time, catastrophic reduction of forest area, destruction of forest soils, impact on wildlife are the basis for forming knowledge about the ecological effect of the recreation process. That is, the time

has come for a person to reasonably plan recreational load, taking into account the status of protected areas (botanical gardens, national parks, reserves, hunting farms, etc.). When studying the importance of these territories, it is advisable to focus students' attention not only on their environmental need, but also on social and economic essence, historical role in the processes of anthropogenic factors formation and management of biosystems. It is important that the student learns the fundamental difference between the use of nature by man and animals. A person in the process of using natural resources can thus change the environment in accordance with their own goals, which are aimed at meeting the needs for food, water, raw materials and energy.

4.2.2 In geography lessons

Geography studies the unity and integrity of the types of natural-territorial entities and territorial-industrial complexes that are formed in the result of human economic activity. Therefore, in geography lessons, eco-logical knowledge should be aimed at explaining the structural structure and value of nature, its economic and vital importance to man and society. In the lessons of geography, an important role should be given to explaining the integrity of nature, the analysis of all components of the environment, their mutual influence and the causal connection between them. In the lessons of geography it is very effective to show that in connection with the rapid growth of production, intensive construction of new and expansion of the territories of existing cities, development of new territories, creation of large industrial and agricultural complexes, society needs new, large means and funds to maintain optimal characteristics of the environment. It is important to emphasize that it costs less to restore the destroyed environment (reforestation of large areas, clearing of poisoned water bodies) , disposal of household and industrial waste, restoration of fauna and flora, etc.). Particularly favorable pedagogical conditions for ecological and economic discussions are created when studying the problems of forecasting the development of regions, construction of new industrial complexes, etc. That is, geography can play an integrating role in the environmental education of high school students. It should be remembered that, as a result of human action, the biosphere has gradually become a noosphere - the result of human action on the biosphere [110].

In the general courses of natural science and physical geography, physicochemical factors of the environment are studied - climatic, soil, geo-morphological and hydrological phenomena and processes. Biotic factors of the environment - plants and their groups, animals, their species and location features in connection with the soil and climatic conditions are studied as components of

the geographical envelope. Human influence (anthropogenic environmental factors) on inanimate nature, organisms and their grouping are considered in the analysis of human action on different types of landscapes within the boundaries of natural zones and ozonal natural complexes.

Thus, it can be argued that the course of physical geography deals with the main environmental problems related to the analysis of particular geospheres: summer, hydro, atmosphere, geographical envelope, biosphere; continents; territories of states and their individual regions.

In the course of economic geography, the main focus is on a comprehensive analysis of the territories, in terms of economic activity, its resources and ways of sustainable use of nature. The article deals with economic and environmental problems, and focuses on scientific approaches to the issues of the use of territories and natural resources in the organization of social production. In this section, it is advisable to focus on the disclosure of the interaction in the scheme "nature - man - society" in terms of ecological and economic interpretation.

For example, in topics of general physical and geographical survey, it is advisable to focus students' attention on the following environmental problems: rational use and conservation of natural resources across the world, country, and region; the role and importance of climate in nature and people's state-gift complex; human impact on water exchange in nature; soil erosion and corrosion and measures for their protection; the concept of natural resources; protection of subsoil, water, fauna and flora; reserves, their role in human life; laws on nature conservation.

In studying the geography of the region of the development of ecological and economic education contribute to the study of minerals, their impact on the state of the regional economy; climatic conditions of agricultural development, state of water use; nature conservation measures in the region; characterization of development prospects. For example, in Transcarpathia, it is advisable to pay particular attention to the analysis of the activities of the forest and wood processing industry, the state and use of forests, forest resources and resources; use of mineral and thermal waters, unique minerals (kaolins, zeolites, polymetallic ores, etc.).

In the most general terms, greening the process of teaching geography at school should include:

- acquaintance of students with different kinds of natural resources and resources, their value and value in human life; the need for their preservation and rational use;

- specification of geographical knowledge about the interconnection of the components of nature in the process of their use;

- elucidation of human impact on different objects of nature and the natural complex as a whole, analysis of this impact and its consequences;

- selection of ecologically favorable factors for human life;

- acquaintance with legal norms of scientifically grounded attitude to nature.

4.2.3 In chemistry lessons

Chemistry, as a science, examines the structure of substances, their transformation and role in the ridge. Therefore, the role of school chemistry course in environmental education is determined by the fact that this science is connected with the knowledge of the laws of nature, the chemical form of movement of matter and its role in society. Chemistry does not directly study living systems, but the environment is a collection of substances that are in a state of constant chemical transformation. School course of modern chemistry, considering the chemical elements, their compounds and role in nature, can significantly expand the students' understanding of biotic factors, one of the elements of which is the chemical composition (quantitative and qualitative) of water, air, soil. However, it is important to note that in nature, a certain dynamic equilibrium has been established between these chemical characteristics and parameters, that there are certain limits to their change and that their magnitude is a limiting factor for organisms and entire systems. For example, it is known that natural waters are characterized by a hydrogen index whose value is in the range of 6.5 to 8.3. Deviation of it in one way or the other suggests a change in bio- and geochemical processes in aquatic ecosystems.

Mach (water oxidation effect).

From the point of view of chemical action on nature the following main directions should be distinguished: use of natural chemicals; pollution of the suburbs by waste; occurrence in nature and, as a partial case, in the biosphere of new highly active chemical compounds released from natural sources or artificially synthesized by man.

The first direction can be illustrated both in the course of inorganic and organic chemistry, when considering natural compounds as raw materials for many sectors of the economy, which underlie chemical processes. First and foremost, the issue of the use of natural and synthesized substances in the role of mineral fertilizers and poison chemicals. It should be noted that as a result of these actions there is a redistribution of chemicals in the biosphere, which causes a change in the chemical indices of the environment [44].

When studying the physical and chemical properties of all kinds of substancesand special attention should be paid to the pollution of nature by various wastes of production. The appearance

in the biosphere of various chemicals, especially synthesized and not characteristic of nature, should be considered as a violation of the natural processes of metabolism, reducing the intensity of self-purification. It is important to show that pollution of the biosphere is usually caused by the imperfection of technology and technology, which creates a flow of substances that disrupts natural exchange processes in nature.

Students should focus on improving and creating new techniques and technologies, increasing the output of finished products, reducing the amount of waste and runoff of contaminated water, recycling waste and translating processes into closed technological cycles. The main point here is the idea that human connection with nature can be optimized if all human activity is based on scientific knowledge of nature.

4.2.4 In physics lessons

Physics plays a leading role in the coverage of natural science and technology aspects of ecology. This is primarily due to the fact that it studies the most general and fundamental laws of nature, creating the basis for the formation of worldviews of nature as a coherent system of interconnected natural phenomena and processes [51].

Being the basis of modern technology, physics helps to find out the reasons for the deterioration of the conditions of existence of nature, to predict the possibilities and ways of solving many environmental problems [36].

The content of the school course of physics enables the purposeful work to prepare students for environmental activities in many fields of modern production, and for this the teacher must have a clear understanding of the content of environmental education, its structure: to know the characteristics of the process of organizing environmental education in lessons physicists, be able to choose such training methods that would ensure the high efficiency of this process.

Ecological knowledge in the school course of physics is usually referred to as applied, their development helps to realize the principle of polytechnism at school. In the school physics course, the principle of polytechnism should be understood as familiarizing students with the physical foundations of the modern industrial base. By studying the scientific fundamentals of mechanization, energy, electrification, instrument-building, material science, the teacher is able to consider different directions of modern scientific and technological progress not only for the purpose of polytechnic and vocational training of students, but also to explain the negative effects of its impact on the environment (growth the average effective temperature of the Earth, the thermal

death of the universe, the effects of the atomic war, the ozone window, the emissions of production wastes, radioactive waste, etc.) In this regard, under the polytechnical aspect s ro knowledge should be able to knowledge of the physical basis and engineering processes and can be grouped into three sections [36.44].

I. Methods of development and use of clean energy sources principle of organization of clean production. The clean sources of energy include rivers of wind, solar radiation and other natural energy sources. Clean industries include those that use clean energy, as well as those production processes whose cycles are closed. Pure sources of energy and production are characterized by the fact that they do not require special measures to protect natural systems from their effects. They in themselves eliminate the harmful effects on the environment.

II. The rational use of natural resources or the reduction of energy and material costs per unit of useful output. This approach requires the development of knowledge about:

- methods of increasing the efficiency of technical devices and technological processes;
- ways of realization of waste-free technologies;
- methods of using secondary material and fuel and energy resources;
- ways to reduce energy and raw materials consumption.

Since, in the general case, the production of raw materials and energy is accompanied by some environmental pollution, these issues need to be given considerable attention. In addition, it should be remembered that, according to estimated data, about one-third of all reserves for improving the efficiency of social production account for increasing the efficiency of natural resource use. For example, integrated use of raw materials allows to increase output in ferrous metallurgy, chemical, petrochemical and some other industries by 15%, in non-ferrous metallurgy - by 20%, in the processing of copper ores - by 30%, etc. When using secondary resources, there is no not only reduced costs of raw materials and thus increase the efficiency of production but also reduces the amount of emissions of harmful substances into nature. Effective use of waste as one of the strategic directions of resource saving brings not only economic but also social and environmental effect to society.

III. Principles of operation of protective systems. These include various kinds of protective processes in the sections of molecular physics (purification and separation of gases), electricity (protection from the action of electric and magnetic fields), quantum physics (various types of radiation), and so on.

Traditional methods of protecting the environment from pollution by production wastes are based on the creation of environmental protection means. Modern wastewater treatment plants and

systems do not always provide the necessary degree of purification from the harmful substances of the production wastes. Therefore, in the course of physics, it is advisable to pay attention to the relationship of the problem of intensification of production and environmental activities. The extensive use of natural resources is accompanied by a large increase in waste and pollution.

When disclosing the problem of greening production, as one of the important areas of scientific and technological progress, it is advisable to follow the following sequence. The introduction to this section of physics should emphasize the major environmental problems that arise from the physical phenomena studied here. As you study the material, familiarize students with the operation of certain mechanisms and new technological processes that take place there, focus on possible methods of increasing efficiency, reducing energy consumption and the amount of raw materials used for each unit of production. At the end of each section, it is advisable to summarize students' knowledge of production organization, its environmental impact and possible ways to improve the situation.

For example, on the topic "Environmental problems of energy" it is advisable to conduct a generic cross-curricular lesson, which is appropriate to reveal the physical, chemical, biological, geographical aspects of this problem. This lesson should highlight the environmental problems associated with the development of energy and the causes of their occurrence:

- the situation with raw materials for the energy industry;
- waste from burning coal, oil and gas at the TPP;
- problems of water resources and the work of GRES;
- radioactive waste at NPP;
- prospects for energy development.

Extremely intensive in recent years, such sectors of the economy as radio and television. In areas where high-power and medium-sized radio stations and telecentres are located within a radius of 1.5 km from the antennas, the electromagnetic field intensity in the open area is 0.2-6.0 V / m, and in residential buildings - 0.2-3.2 V / m [110]. Levels of high-frequency energy of radar stations exceed 5 μW / cm2 in continuous generation mode and 10 μW / cm2 - at pulse. In the first case, this is 3 times the maximum permissible electromagnetic fields, and in the second - 5 times. A comparison of the radiation power of the Sun at the biologically active frequency of 200 MHz and the power of radiation at the same frequency propagating from the antenna of the telecentre, indicates that the artificial source is 102-103 times more intense than the Sun. Such changes in the electromagnetic background become the cause of cell mutagenesis, leading to a change in the normal level of the evolutionarily formed intercellular bond. Moreover, human evolution has taken

place over millions of years, and the effects of artificially created electromagnetic fields have been experienced by living things for the past 50-70 years.

Therefore, in the lessons of physics, when studying the section "Electromagnetic waves", it is advisable to devote some part of the time to information of ecological content. It should be emphasized that the electric field causes ionic currents in the tissues of the human body, proportional to the specific conductivity of the tissue. The magnetic field influences the direction of movement of salt ions in the human body. In the meter range, standing waves can form in the human body, in the lows and highs of which the magnitude of the field can be increased hundreds of times.

It is advisable for the teacher to characterize each range of radio waves in terms of their impact on living organisms. It is advisable to emphasize that short and ultra-short waves are absorbed by tissues of living organisms more intensely than waves of long and deep waves regular range. The biological activity of radio waves increases with decreasing wavelength. Of all frequencies, the most absorbed and the most active, in terms of action on living organisms, are waves of the centimeter range (3.109-3.1010 Hz). They are most used in all fields of science and technology.

An extremely energy-intensive sector of the national economy is the transport port, accounting for almost 14% of all energy use. Traditionally, the improvement of the power units of transport engines is aimed at increasing their energy efficiency, reducing fuel and energy costs. The efficiency of modern engines does not exceed 40%. In the long term, high-temperature adiabatic internal combustion engines (so-called ceramic motors with efficiency up to 55-60%) can be used in transport. Therefore, in such sections of physics as mechanics. molecular physics and thermodynamics, it is advisable to pay considerable attention to improving the efficiency of various mechanisms not only as an improvement of the technological cycle, but also as a resource-saving factor and a factor of improvement of the ecological state as a whole.

An extremely important area of resource conservation is the reuse of household waste. This trend has an extremely important environmental and social impact, as household waste accumulates in the habitats of large numbers of people. In addition, the use of waste is of economic importance. Up to 20 million tonnes per year are formed in the state, they occupy large land territories - a city with a population of 40 thousand people. 1 ha of land is required each year to dispose of household waste. In many cases, household waste can become a raw material for various industries, because they contain about 40% of paper and cardboard, up to 5-10% of glass, 3-4% of metal and a number

of other useful components. Work on the use of household waste has been steadily expanding, but it has not yet grown.

Particularly important in resource conservation is the problem of water economy. In addition to the development of anhydrous and low-water technologies, accelerated rates need to be created in the production of a closed water supply system. Large reserves of water saving are in irrigation land use and housing and communal services.

Considerable reserves of resources are contained in the integrated use of forest resources. Today, the economic and environmental aspects of forest in Ukraine go far beyond its use only as timber. Its ecological and socio-economic role as a water- and climate-regulating, sanitary-hygienic and wellness factor is growing. Forest, in addition to the source of wood, is a major factor in the conservation and improvement of the environment. Forests are important in combating water and wind erosion.

Thus, the main focus of the research process is on the creation of scientific foundations for the development of low-waste, resource- and energy-saving technologies, as well as the improvement of existing technologies with the aim of reducing harmful emissions and utilization of waste, more complete use of secondary resources and production wastes. The main role in solving this problem should be given to science such as physics.

In order to increase the efficiency of environmental education at school, it is advisable to supplement the course of physics with the following list of program questions: physics, technology and nature protection (VI class); application of the laws of mechanics for nature protection (VIII class); application of the laws of electrodynamics in nature protection (class IX); energy and environmental issues (Grade X); nuclear and nuclear energy and nature protection (XI class).

4.3 Environmental education in the humanities cycle

Ecological approach in school education organically involves the disclosure of the idea of the role of nature in the development of personality, its spiritual enrichment, moral and aesthetic education. The role of nature in the development of personal qualities consists in the cultivation of kindness, which warns against thoughtless, meaningless evil and barbaric attitude towards nature; in the formation of moral attitudes: nature is a nation-wide property and should be treated wisely and carefully.

Literature, as a creative word and academic subject, has great potential for environmental education of young people. Literature makes a significant contribution to the development of the

concept of interaction of man and society with nature, revealing such aspects of it as the general worldview and moral value connection. The challenge of literature in the school curriculum is to teach students to think independently and make scientifically sound decisions about the role of man, society, and nature in modern life. Fiction is filled with many facts of nature that highlight the value of nature, the richness of its resources, the ethical and aesthetic beauty of the impact of man on nature and the last on human society [41,42].

Becoming an environmentally educated person in the context of the pedagogical process is subject to an organic combination of scientific knowledge of natural and social factors of the environment with its sensitive perception, which awakens aesthetic experiences and causes a desire to make a practical contribution to its improvement. This principle of ecological education and upbringing is oriented towards supplementing rational knowledge by the process of artistic and figurative thinking. The relationship between rational and emotional in practice is dynamic and depends on the age of the students. Obviously, in the younger classes, emotional and aesthetic perception of the environment has the greatest weight, and intellectual perception of the world is in the background. In adolescence, there is an equivalent manifestation of them, and later the intellectual understanding of nature becomes more powerful. At the same time, the artist's perception of the world does not lose its significance, it has an even deeper influence on the formation of young man's actions in terms of interaction with nature.

It is important to point out the following. The history of nature is closely linked to the history of mankind, but in the school course of history, the process of development of human society is considered in isolation from nature. Since history is intended to help the understanding and comprehension of the most urgent problems of the modern historical stage of society, one of its main tasks should be considered as the prevention of the global ecological catastrophe and the self-destruction of civilization. This means that the school course of history should introduce knowledge about the development of relationships between society and nature, which change in accordance with the development of any socio-economic formation. This can be illustrated in the following way.

At the beginning of the existence of civilization, man enters into a relationship with nature as a "blind element". Primitive tools did not separate man from nature. The tools of labor provided the person with survival and entry into the system of natural connections. This period lasted millions of years. However, with the growing number of people, the emergence of large settlements, nature no longer provided for the existence of humans with sufficient food. With the development of agriculture and domestication of wild animals man has entered into a new relationship with

nature. This has led to a new ecological connection and created new forms of human interaction with nature. This period was characterized not only by the fact that man took from nature, it began to create. Later, the contradictions between man and nature grew even more, new forms of destruction of nature emerged, and global ecological crises emerged. Creating artificial biocenoses, people began to intensely destroy natural bonds.

In studying the history of the ancient and middle ages, we can cite a number of examples, when humanity transferred to the nature of the problem of society. Nature was considered a constant, constant value, human activity was considered regardless of nature. Only in the Renaissance did the applied sciences begin to develop intensively, the accumulation and systematization of knowledge about nature began, and the interconnections of nature and society were opened. The last centuries of the development of human civilization were accompanied by the accumulation of great material wealth, but this period is also characterized by the further alienation of man from the problems of nature. Consumer attitudes towards nature have posed a threat to society.

4.4 Cross-curricular links in the environmental process education

The experience of various authors in the implementation of environmental education shows that one of the primary tasks is to identify the specific capabilities of each subject in this problem. Potentially important environmental knowledge is difficult to integrate into the program. their volume is very large and constantly growing, in one program to reduce them is probably impractical. The content of the curriculum in different subjects is anticipated and allows students to absorb knowledge that is directly related to environmental conservation and rational use: natural resources. These programs only need to give the appropriate direction and integrate knowledge of different topics and subjects around the main problems that today need to be solved by mankind as a whole, individual states and each individual in particular. This approach allows students to formulate the concept of a holistic picture of the world, and to combine the acquired environmental knowledge with one common idea of care for the preservation of the environment and the multiplication of its riches [110].

Cross-curricular links in the study of environmental material are implemented in different ways and perform different functions. The main here should be considered the expansion and deepening of knowledge in each subject, a more complete understanding of them, the implementation of basic educational tasks. On an integrative basis, in the process of environmental education, teachers of all subjects have the opportunity to significantly increase the knowledge of

students in the fields of health, raw materials and energy, food security, space exploration, oceans, development of scientific and technological progress. For the implementation of the system of environmental education on a cross-curricular basis in [44,45], teachers are recommended to draw up a summary map, which provides the following sections:

- - environmental education programs under a special program;

- the possibility of integrating the content of sections of the special program and the content of knowledge from the school foundations of science in lessons;

- possibility of realization of the content of sections of the special program in the process of extracurricular work;

- functionality of environmental education.

Based on the summary map, each subject educator draws up his or her specific individual map. The didactic nature and value of this approach should be noted. The charts allow us to generalize knowledge and act as a cognitive tool with respect to lower-level knowledge, which is the knowledge of each individual discipline. Consolidated mapping schemes are intended to become a unifying systemic, integrating factor of all school knowledge around environmental issues.

An example of the topic of environmental education through the use of cross-curricular links should be given. The problem of fertile soils is an extremely important conservation issue. In the sixth grade, students should be given information about the areas they use today for plowing, pastures, hayfields, their condition, sources of soil contamination, the impact of NTPs and production on the yield of basic crops in the study of the topic "Soil" from the course of geography. Further it is advisable to deepen this information in the lessons of physics, chemistry, biology and other subjects. In the upper classes, students learn about the specific impact of industry, motor transport, production culture, in general, the process of urbanization of our lives on the magnitude and physical and chemical status of fertile soils. It is advisable to make the analysis of the acquired knowledge in the lessons of biology and social sciences. Students should logically conclude that, on the one hand, the development of NTP is aimed at improving the material conditions of life of people, and on the other - leads to a decrease in areas of fertile soils, their pollution becomes a threat to human health. A radical solution to these contradictions should be sought, on the one hand, in the improvement of technological processes, the development of waste-free technologies, and on the other, in the education of highly educated specialists in environmental protection.

In general, an integrated approach to environmental education allows [46,64]:

- coordinate the efforts of all school teachers to implement optimal conditions for environmental education;

- to provide a deep understanding of the environmental problems of today;

- to promote the formation of students' knowledge of a holistic scientific picture of the world, the relationship and contradictions between nature and society;

- use the potential educational opportunities of environmental education to form the outlook, aesthetic and physical education of students;

- to formulate the attraction to research work in the field of protection of our country the environment;

- to shape the ecological culture of the state as a whole.

4.5 Social aspects of environmental education

There are complex relationships and relationships between man and the environment that allow man to live as a natural and social being. Throughout history, humans have more or less tried to establish a "parity agreement" with nature. The demographic explosion, the scientific and technological revolution led in the XX century. to the great pressure of man on nature. Negativism of the consumer attitude of the person to the nature became especially great in the post-war period, but at the same time the people's understanding of the problems of the ecological crisis increased. There is a growing awareness that humans are not only users of natural resources, and that the violation of the ecological balance in nature, which is influenced by intense human activity for the development of nature, can endanger life itself on Earth. Environmental problems are the subject of research not only in the natural sciences but also in the social sciences. In the last decades, environmental movements and parties have begun to emerge. Environmental protection and formation are the subject of sociological research, and a separate branch of sociology has emerged - social ecology [30,68].

But despite the fact that in terms of understanding the ecological situation of clear formation of environmental problems, certain results have been achieved, the state of the environment has not changed for the better. The degradation of the environment is not only the result of extremely rapid industrial development, which is not always accompanied by sufficient measures to protect nature, but is also a consequence of a one-sided, technocratic and economic approach to the development of productive forces and relations, a low ecological culture that does not allow to carry out consistently: environmental protection measures.

In modern society, following the rapid development of productive forces and their uncontrolled use in the development of nature, ecological equilibrium has become disturbed, which gradually developed into an ecological crisis. Violations of the ecological equilibrium led to pollution of the atmosphere, sewage and seawater, accumulation of solid and liquid waste, the emergence of large noises, radioactive waste, pesticide contamination of food, etc. Man instead of getting to know nature better, the laws of its development began its intensities. destroy and pollute. Today it has become clear that environmental degradation is not a product of temporary and accidental disturbances, but a product of scientific and technological progress. It is a symptom of the deep contradictions of the industrial development of civilization. Therefore, the further development of human civilization requires a scientific and deep rational approach to the development of nature, which should be based on a new scale of values. An ecological crisis in this approach should be considered as a crisis of humanity (humane nature and themselves). The negative effects of industrial development at any cost, without regard to economic and environmental aspects, affect the social, economic, psychological and moral conditions of human existence.

Since environmental problems are at the core of "socio-economic character" associated with understanding of social life and the prospect of development of human civilization, it is time to talk about social ecology as a science that affirms attitudes and positions in society and influence these concepts to the natural environment, and the latter should be studied as a causal factor in social development. In general, this new concept of the general sociology of our planet encompasses the relationship of wild and inanimate nature and their impact on social development, as well as the impact of social development on the natural environment, as they are interconnected and interdependent.

4.6 Recommendations for the organization of environmental education work at school

The complex of ecological and educational activities at school should ensure the integrity of the system of environmental work, its scientifically sound structure, content, organizational levels, performers, working conditions, tasks, methods and methodology. It is appropriate to plan this work in school together with scientists of the university or institute. As a rule, the program of integrated environmental education consists of theoretical, practical and experimental parts [64,110]. It is appropriate to anticipate the following basic organizational levels of implementation: lessons in all subjects; classroom hours, part-time work, homework.

Performers: subject teachers, classroom leaders, student organizations, circles, nature club.

Consultants: natural scientists, production specialists, members of the conservation society.

Conditions: professional self-education of teachers, proper material and technical base, links with scientific institutions and production teams.

Aspects:

1) cognitive - expansion of knowledge about the scientific picture of the world, the formation of skills and skills to protect it;

2) educational-formation of scientific outlook, ecological culture, love for nature, frugality, positive social orientation;

3) developing - development of creative abilities, skills of research work.

Principles: a comprehensive approach; realization of cognitive, educational and developing functions; implementation of inter-subject and inter-subject relations; formation of interest and environmental independence of students; deepening and strengthening of students' knowledge in various subjects; continuity in learning.

It is advisable to consider the developed structural scheme at a meeting of the School Board and to agree in the district methodical office. When developing and discussing the program, it is advisable to find out the possibilities of teachers of each subject in the implementation of environmental education, to identify the relevant sections and topics of the curriculum for integrated study. Generate basic environmental ideas that can and should be studied with reference to the problems of the state, region, city or village. Identify topics that can be explored on the basis of existing production teams in the region. At the same time, it should be noted that the program allows to realize the development of students' creative abilities, including their observability, the power to research and socially significant work, against the background of which to organize the active acquisition of knowledge.

Environmental work should be carried out continuously at all levels of the organization of the educational process, in all subjects, based on the principles of connection of theory with practice, science, interdisciplinary and individual approach. For the development of students' natural-cognitive interests, it is advisable to use the following methodological techniques: various observational topics, specific scientific researches, complex cross-curricular excursions, discussion of individual topics, their design in the form of cinema, photo materials, abstracts papers to report at relevant scientific conferences.

To prepare teachers for environmental education and upbringing of students, it is advisable to select scientific, historical, political, regulatory materials closely related to environmental

problems. All the work of teachers should be directed to the elucidation of the scientific basis of environmental protection, to the awareness of the role of scientific knowledge as a productive force of society, to stimulate the educational activity of students, to form in them the belief that the progress of society is impossible without a deep environmental awareness of people.

Once a year, it is advisable to hold school scientific and practical conferences on environmental education. Each conference develops a script, topics, identifies the performers, participants, prepares the exhibit, invites scientists, parents of students. production representatives. At such conferences, students make abstracts, report on scientific results, observations, socially useful work, organize quizzes, competitions, exhibitions. The best works of students should be noted and recommended for participation in competitions of district, regional and all-Ukrainian levels.

4.7 Environmental self-education of students

Environmental self-education is an important means of deepening students' knowledge, developing their creative abilities, skills of scientific and research work, independence in solving various problems of nature protection. The self-education of nature conservation work must be done purposefully, and the war is organized on the basis of an individual, differentiated approach. It is advisable for students of grades 5-8 to recommend thematic non-fiction, to develop skills to work with it "with a pencil in their hands", to outline the main places from the readings, to write out the necessary data, to make thematic collections of literature. Students can independently work literary material on separate topics, for example [45]: "Forest pharmacy", "Folk wisdom about nature", "Signs and nature", "Nature in the sayings of outstanding people", etc. it is advisable to combine the work of students with the study of environmental problems in the region. This work should be done under the guidance of subject teachers. At the request of the geography teacher, students can work on, for example, the theme "Birds of their native land." At the same time the students' attention should be focused on the questions: what birds inhabit the region, their species and population numbers, their importance in human life, especially migration processes. The results of the study and observations can be summarized in the form of abstracts, and it is advisable to record daily observations in the observation diary.

Under the guidance of biology and geography teachers, systematic observations of climatic conditions can be arranged with students. In doing so, it is advisable for students to orient not only formally record natural phenomena, but also to look for certain patterns and connections between

the various processes, to predict their development and possible impact on agriculture. When working on such a problem, it is necessary to collect literary data, newspaper publications on the subject, memoirs of old-timers, folk signs. In this regard, students' attention should be focused on changing the surrounding landscape over time, such as deforestation, soil erosion, landslides, river shallowing, lower groundwater levels, acid rain, etc.

It is advisable to plan students' self-educational work for the holidays. It is advisable that it be a continuation of previous work, but it is not necessary to exclude arbitrariness in the choice of topics. This approach ensures the implementation of the principle of a differentiated approach to planning students' self-education. It is so much more interesting for students to work, their knowledge is updated with new data, they start working in the pre-layer mode.

In the upper classes, more complex and varied conservation work should be planned, including scientific elements and practical work, such as the identification of sources of pollution of the atmosphere, soil and water, optimal use of forest resources, subsoil resources, the state of local monuments. nature, etc.

High school students in the field of environmental education should focus on cooperation with relevant specialists, scientists, on the development of self-study skills and dissemination of environmental knowledge among the population. At the same time, students should focus on solving the problems of optimization of relations between man and nature, forecasting the consequences of violation of natural laws, the study of legislation on nature conservation, analysis of publications in the local press on environmental topics.

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APPENDICES

Annex 1 DECLARATION ON ENVIRONMENT AND DEVELOPMENT (RIO DE JANEIRO)

United Nations Conference on Environment and Development held in Rio de Janeiro from 3 to 14 June 1992,

Reaffirming the Declaration of the United Nations Conference on the Environment, adopted in Stockholm on 16 June 1972,

and seeking to expand it with a view to establishing a new and equitable global partnership by reaching a new level of cooperation between States, the basic public sectors and people,

acting in pursuit of international agreements that take into account the interests of all and safeguard the integrity of the global environment and development system,

Recognizing the integrity and relationship of nature on Earth - our home, proclaims:

Principle 1

Man is at the heart of sustainable development. She has the right to a healthy and productive life in harmony with nature.

Principle 2

In accordance with the UN Charter and the principles of international law, States have the sovereign right to exploit their own resources in accordance with their own environmental and development policies and are responsible for ensuring that activities within their jurisdiction or control do not harm the environment of other States or territories outside state jurisdiction.

Principle 3

The right to development must be exercised in such a way as to rightly meet the needs of present and future generations for the environment and development.

Principle 4

In order to achieve sustainable development, environmental protection must be an integral part of the development process and cannot be considered in isolation.

Principle 5

All states and people must join forces to tackle the crucial problem of poverty eradication in order to reduce disparities in living standards and better meet the needs of most people in the world, which is an indispensable requirement for sustainable development.

Principle 6

Particular priority should be given to the particular situation and needs of developing countries, in particular the least developed and the most environmentally vulnerable. International environmental and development activities must also take into account the interests and needs of all countries.

Principle 7

States should cooperate in a spirit of global partnership to preserve, protect and restore the healthy and holistic status of the Earth's ecosystem. States have common but differentiated responsibilities, given the different proportions of participation in global environmental degradation. Developed countries are aware of the responsibility they have under international aspirations for sustainable development, given the impact they have on the global environment, and the technologies and financial resources they possess.

Principle 8

In order to achieve sustainable development and a higher quality of life for all people, states must reduce the number of volatile production and consumption patterns and abandon them by promoting sound demographic policies.

Principle 9

States should join forces to strengthen the process of enhancing internal opportunities for sustainable development by enhancing the on-going scientific processes, sharing scientific and technical knowledge, and accelerating the development, borrowing, diffusion and transfer of technologies, including new and innovative technologies.

Principle 10

Environmental issues are best addressed with the involvement of all concerned citizens at the appropriate level. At the national level, each individual should have adequate access to environmental information held by public authorities, including information on hazardous substances, materials and activities, and should be able to participate in decision-making processes. States should promote public awareness and participation and facilitate these processes by making information widely available. There should be a fair opportunity to hear administrative or judicial cases, including damages and rights protection cases.

Principle 11

States must adopt effective environmental legislation. Environmental standards, objectives and management priorities must be appropriate to the environmental situation and development conditions to which they apply. Standards applied in one country may be unacceptable and unjustified economically and socially in others, particularly in developing countries.

Principle 12

States should join forces to establish an open international economic support system that will promote economic growth and sustainable development in all countries, as well as better address the challenges of environmental degradation. Environmental policies envisaged in trade policy should not be a means of arbitrary or unjustified discrimination or a hidden restriction on international trade. Unilateral action on protection against environmental hazards outside the jurisdiction of the importing country should be avoided. Environmental measures to address interstate or global environmental issues should, where possible, be based on international consensus.

Principle 13

States should develop domestic legislation on legal liability for pollution and other environmental damage, as well as compensation for victims. States should also urgently and decisively join forces to further develop international legislation on legal liability and compensation for adverse effects arising from activities within their jurisdiction or control, or causing environmental damage to territories outside their jurisdiction.

Principle 14

States should cooperate effectively to prevent or prevent the transfer, transfer or transfer to other States of any activities, substances or materials that cause serious environmental degradation or cause harm to human health.

Principle 15

In order to protect the environment, States should, to the best of their ability, make extensive use of preventative measures. Where there is a risk of serious or irreparable harm, the lack or absence of clear scientific evidence should not delay the implementation of cost-effective measures to prevent environmental degradation.

Principle 16

Public authorities should make every effort to promote the internationalization of environmental costs and the use of economic instruments, based on the principle that the polluter should, as a rule, offset the cost of eliminating pollution with due regard for the public interest and without public interest. violation of international trade and investment conditions.

Principle 17

One of the instruments of public policy should be the environmental impact assessment of the proposed activities, which are expected to have a significant adverse environmental impact and are therefore subject to review by the competent public authority.

Principle 18

States should immediately inform other countries of environmental catastrophes and other emergencies that could cause a sudden adverse environmental impact in those countries. The international community must make every effort to assist the countries affected.

The Sariigi principle! '

States should inform and make available to threatened States, in a timely and timely manner, activities that may have a significant transboundary impact on the environment.

individual countries, and should consult with these countries at an early stage and with full openness.

Principle 20

Women play a vital role in managing the environment and development. Therefore, their full participation is necessary for sustainable development.

Principle 21

The creative inspiration, ideals and courage of young people around the world must be mobilized to build a global partnership in order to achieve sustainable development and secure a better future for all.

Principle 22

Humanity and its communities, as well as other local communities, play a vital role in managing the environment and development through their knowledge and traditions. States should recognize and properly support their uniqueness, culture and interests, and should enable them to participate effectively in achieving and sustainable development.

Principle 23

The environment, natural resources and population of the area under oppression, domination and occupation must be protected. Principle 24

Wars, by their very nature, have a destructive effect on sustainable development. States should therefore, in armed conflicts, comply with international environmental law and, if necessary, join forces in its further development.

Principle 25

Peace, development and the environment are interdependent and inseparable. Principle 26

States must resolve all their environmental conflicts peacefully and by appropriate means in accordance with the UN Charter. Principle 27

States and people must cooperate in good faith and in partnership with each other in the implementation of the principles set out in this Declaration and in further improving international law to promote sustainable development.

Appendix 2. CHAMBER OF THE INTERNATIONAL CHAMBER OF COMMERCE ON ENTREPRENEURSHIP PRINCIPLES

1. Corporate priorities

To recognize environmental management as one of the highest priorities of the corporation and as a decisive factor for sustainable development; to determine policies, programs and policies for operations, reasonably relevant to environmental issues.

2. Integrated management

Integrate policies, programs and policies into every type of business activity as essential controls in all its functions.

3. The process of improvement

Continually improve policies, programs and environmental characteristics, taking into account technical advances, scientific understanding, consumer needs and societal expectations, starting from legal norms as a starting point, and applying environmental criteria internationally.

4. Employee training

To educate, train and encourage employees to act with an awareness of personal responsibility for the environment.

5. Preliminary evaluation

Assess possible environmental impacts before starting a new activity or project, and before dismantling a manufacturing facility or leaving it after its shutdown.

6. Products or services

Develop and deliver products or services that are environmentally friendly and safe in their intended use and efficient in the use of energy and natural resources, as well as those that can be recycled, reused or stored safely.

7. Advising customers

Advise and, where appropriate, educate customers, trade organizations and the public on the rules for the safe use, transportation, storage and disposal of products supplied, and apply a similar approach to service delivery.

8. Equipment and work

Develop, design and operate equipment and work, taking into account the need for efficient use of energy and materials, the fullest possible use of non-renewable resources, minimizing the

adverse environmental impacts of waste generated, and the need for safe and responsible disposal of non-recoverable waste.

9. Research

Conduct or support environmental studies of raw materials, products, products, processes, emissions, and wastes related to the activities of the enterprise, as well as investigate ways to minimize adverse impacts.

10. A precautionary approach

Modify production, marketing, use of products, services or other activities in accordance with scientific and technological progress in order to prevent serious or permanent environmental degradation.

11. Contractors and Suppliers

Promote the adoption of these principles by contractors acting on behalf of the enterprise, encouraging and demanding, where appropriate, improvement in their working practices, to align them with the practices of the enterprise, and encouraging suppliers to adopt these principles more widely.

12. Emergency readiness

Develop and maintain, in all cases, significant emergency preparedness plans in conjunction with emergency services, relevant authorities and local communities, recognizing the potential for the spread of adverse environmental impacts beyond individual territories.

13. Dissemination of technology

Promote the dissemination of environmentally sound technologies and management practices in the industrial and public sectors.

14. Contribution to the overall result

To participate in the development of public policy and business activity in the implementation of governmental and non-governmental programs and educational initiatives, which will improve environmental awareness and environmental protection.

15. Openness

Create favorable conditions for understanding interest and needs, as well as for dialogue with employees and the public, preventing and responding to the potential dangers and environmental impacts of work, products, waste or services, including dangers and impacts that are inter-territorial and global.

16. Compliance and reporting

Appendix 2. CHAMBER OF THE INTERNATIONAL CHAMBER OF COMMERCE ON ENTREPRENEURSHIP PRINCIPLES

Measure environmental performance; carry out regular assessments of compliance with internal requirements, legal principles, and periodically provide relevant information to shareholders, employees, authorities and the public.

Annex 3 International organizations and institutions in charge sustainable development issues.

The United Nations Sustainable Development Commission, established in 1992, with headquarters in New York (USA). The Commission shall have the following powers:

a) to monitor the practical implementation of the 21st Century Agenda, to summarize the activities of developing countries and to implement the principles of sustainable development between global fora (Rio, Rio + 5, Rio + 10);

b) to provide instructions and recommendations to the governments of the States on the implementation of the principles of sustainable development;

c) Interpretation of the provisions of the 21st Century Agenda - the UN Interagency Committee on Sustainable Development, established in 1992. Headquartered in New York (USA).

The United Nations Environment Program (UNEP), established in 1972, is located in Nairobi, Kenya. The programme's objectives are leadership and promotion of partnerships, support for efforts by countries and peoples to protect the environment. The program's Global Environmental Review highlights regional environmental issues and governments' actions on environmental issues.

UNDP, launched in 1965; The Secretariat is located in New York (USA). The activities of the program are aimed at coordinating technical assistance provided by the UN, and the program provides grants for sustainable humanitarian development. The major editions of the program include the annual “Human Development Report”.

Sustainable development information is available from the following Ukrainian organizations:

• United Nations in Ukraine;

• NGO "Institute for Sustainable Development";

• Center for Sustainable Development and Environmental Research;

• All-Ukrainian NGO "Ukraine. Agenda for the 21st Century »

• Non-Governmental Organization “Sustainable Development Society”;

• United States Agency for International Development's Local Environmental Action Program.

United Nations Commission on Sustainable Development: http: / /www.iisd.ca/linkages/topics/csd/

sustainable development issues.

United Nations Environment Program, United Nations Environment Program: http: / / www.unep.ch/

United Nations Development Program:

http: / / sunsite. une. edu / ucis / Sustainable, html

Economic Commission for Europe: http: / /www.unece.org

International Institute for Sustainable Development: http://iisdl.iisd.ca

Network of Sustainable Development Organizations (ECONET) http: //www.econet.apc.org/econet/en/issues.html

Sustainable Virtual University: http: / /www.foundation.no/vus/whg.htm

World Business Bureau for Sustainable Development: http: / /www.wbcsd.org/publications / prmedia / press26htm

Sustainable Development Research Institute: http: / /www.sdri.ubc.ca/

Sustainable Development Center: http: / / fcn. state. f 1. us / fdi /

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