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**ECOLOGICAL («SUSTAINABLE») INFRASTRUCTURE AS
REALIZABLE BASIS FOR SUSTAINABLE DEVELOPMENT**

Abstract. The concept of ecological («sustainable») infrastructure, which can become the basis for sustainable development, was created recently [3, 4]. Ecological infrastructure is a complex of urban, regional, global and cosmic, natural, man-made and natural-artificial objects and phenomena, which provide environmentally well-founded preservation environment of human life. It includes a system of knowledge, actions and decisions to maintain elasticity of socio-ecological system of towns and countries, ecological education, conservation of living environment, promote ecological balance, reduce the negative impacts of human activities on the natural environment, with increased resource efficiency and consuming renewable resources, with a gradual transition to negentropy technology. A more realistic creating high-quality ecological infrastructure and the living environment can replace poorly realizable concept of sustainable development.

Key words: ecological infrastructure; sustainable infrastructure; ecologization of infrastructure; sustainable development; wide infrastructure

Ecological infrastructure is a new scientific direction, to help establish a science-based understanding of the role of natural and technogenic factors in shaping human life environment with well-founded quality. The creation of high-quality ecological infrastructure in city and country, its restoration, conservation and enhancement, are the most important tasks. Their decision could replace the poorly realized sustainable development to more realistic concept of creating high-quality ecological infrastructure with well-founded quality of living environment.

Ecological infrastructure is wide evolving complex of natural, natural-manmade (cultural), and completely artificial objects and systems, providing the conditions of preservation of the environment of human life in cities and larger ter-

ritories. Living environment is a dynamic social-ecological subsystem of natural and man-made objects and phenomena, factors of material and spiritual culture, including natural, technogenic, socio-psychological and socio-economic that interact among themselves and with the internal human environment. The space environment and the internal environment of the planet influence on environment of life of nature and human; the internal environment of the human body also is environment of life. This extended interpretation of life environments allows creating a more objective presentation of them. Factors of ecological (environmental) infrastructure evolve along with the evolution of the planet, interact with each other and with humans and affect the living environment (fig. 1).

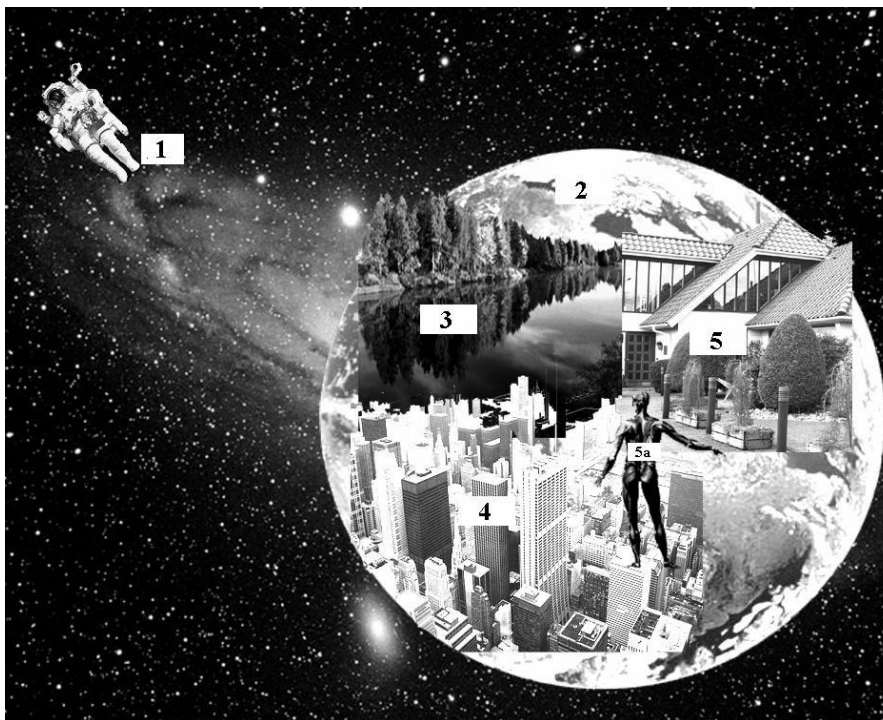


Figure 1. The living environment: 1 - space; 2 - global; 3 - distant; 4 - neighbor; 5 - nearest (house); 5a – internal environment of the body

Ecological infrastructure is fundamentally different from the known (traditional) infrastruc-

ture (table 1). Traditional infrastructure includes the production and social infrastructure, as well as sometimes the natural resources, the living conditions of society. All these components can be included in the environmental infrastructure, provided their ecologization [4]. Environment of human life in both urban and rural settlements and large territories maintain, restore, and provide ecological infrastructure components:

- Positive living environment and a safe space and global environment. -
- Environmentally well-founded volume of all natural ingredients of natural land-

scapes: the atmosphere, the lithosphere, the hydrosphere, and the biosphere. - Environmentally well-founded complex of natural protected territories - reserves, national and natural parks, green areas, protective forests, etc. -Ecological, waste-less, «soft» technologies and systems of construction, industry, energy, transport, agriculture, water, forestry, farming, waste disposal, etc. -Ecological civil (residential and public), and manufacturing (including agricultural) buildings; Nature restoring and nature regenerative buildings and structures. -Clever («intellectual») buildings, cities. -Harmonious, beautiful and comfortable architectural and physical environment of the city. – «Elastic» socio-ecological systems of cities and countries. -The system for the maintenance of the ecological balance with environmental zoning of territories. -Buildings, enterprises, institutions, warning and eliminating adverse natural phenomena and social discomfort, regulating environmental situations (monitoring system, quality management environment, cleaning, etc.) (tab. 1).

Table 1

Ecological infrastructure

Space environment, objects and phenomena near and far space	Global environment of Earth, natural environment and resources	Cultural nature	Artificial environment with entropy and negentropy objects	Internal environment of the human body
Objects and phenomena of space influencing on living environment	Saved by 2/3 of the planet's natural resources and nature	Ecologically well-founded area of cultural nature in cities	Traditional infrastructure with its deep ecological organization	The needs influence on internal healthy environment of the organism
Resilience socio-ecological systems of cities and countries				
Socio-economic environment				

Socio-psychological environment

Maintenance of the living environment also may be provided by elements of traditional infrastructure, after their system ecologization: - Natural resources, including (especially) renewable energy. -Production and delivery system. - Removal and recycling system. -Energy, transport, communications, roads, etc. -The provision of materials and manufacturing processes for environment (water, air, temperature, etc.). -Buildings and engineering structures, transporters, warehouses, etc., to ensure the flow of production processes. - The state of society, the absence of a crisis, ensuring environmentally friendly needs of cities and countries. -Ecological ethics and esthetics, human ecology. -Ecological settlements to ensure urgent (priority) and all other well-founded needs.

It is interesting similarity and difference between concepts of ecological infrastructure and of living environment. The similarity consist in that several components of the ecological infrastructure, supporting high quality living environment is both factors of this living environment: they are parts of nature and cultural nature, they are human living environment. Natural and cultural environment help to support in building a high-quality living environment, at the same time, they are life environment. All the elements of traditional infrastructure must be ecologically to enter as components in ecological infrastructure. The ecologization is necessary for industrial and residential buildings, engineering structures, other components of the artificial environment of the city and the country. All human thinking and activities must be ecologically well-founded [7]. The first is environmental education, knowledge of laws of ecology, environmental philosophy and ethics, the second is the ecologization of the material culture, created to meet human needs, the foundation of which served and serves the nature (materials, energy, landscapes, etc).

Man as a species can exist and develop only in a healthy natural environment of life on Earth [3, 4]. This provision makes as very important task of creating high-quality ecological infrastructure, and reduces the negative trends of technological evolution. The role of ecological infrastructure as the basis for the

preservation of life, as the foundation of «sustainable» ecologically supports development is paramount. This provision is particularly important, as adopted by the UN program «sustainable development» («agenda-XXI») is not performed.

The downside of the ideology of «sustainable development» is that it orients the humanity first of all on development; this is a development that withstands nature, rather than preservation of nature and environment, vital man, without which it would not be able to survive. The concept of «sustainable development» is controversial, and the sustainable development, apparently, is unattainable. Therefore, it seems logical replacement of «sustainable development» concept on «preservation, restoration and maintenance of high-quality living environment on the basis of broad environmental infrastructure», which will allow environmentally soundly oriented thinking and actions of citizens for a solution the most important problems of preservation and restoration of the living environment.

The unique biologically well-founded place of humankind is Earth; its environment is the only acceptable and favorable environment for humanity. Ecological infrastructure options may be realized only under conditions required «resilience» the living environment as a socio-ecological subsystem, which is provided by its ability to adapt in a changing world. «Resilience» living environment that includes ecological and social components is its ability to return to its original state after the changes under the influence of negative factors, the ability to withstand internal and external exposure without changing the basic functions.

Artificial and cultural environment of the city include buildings and structures along with climate of the city, cultural nature and elements of the natural environment, preserved in the city. In addition to these environments a man are in material and spiritual cultural environment that includes all created by the man, his national and ethnic characteristics, knowledge, abilities, skills, level of intellectual, ethical and aesthetic development, norms of morality and right, attitude to nature, etc. Many of these environments overlap and interact (fig. 2). This complex composition of human living environment must ensure ecological infrastructure.

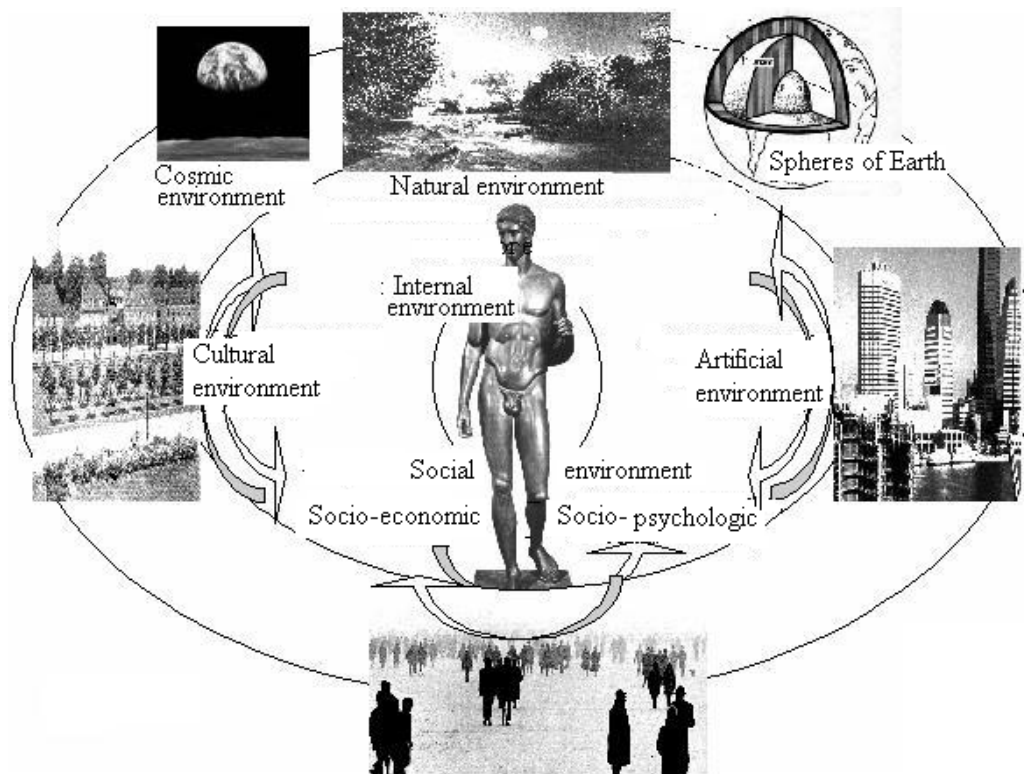


Figure 2.
Composition of the living environment
Ecological infrastructure serves to conservation and ensuring environmentally

sound environment quality of life as the at all levels, from the whole country to the cities and individual buildings and engineering structures. Ecological infrastructure in scale of the country is interoperable between a developed and natural territory, the ratio of which must be environmentally justified to maintain homeostasis and the ecological balance; necessary combination of natural protected areas, ecological territory framework and ecological corridors, large technological systems of traditional infrastructure, renewable energy and renewable natural resources, monitoring system. Ecological infrastructure in the scale of the city is the ecological production and social infrastructure, ecological framework city and green corridors, soil-vegetative layer, ecological, smart and multifunctional buildings, phytomelioration system, permaculture, ecologically restored landscapes and ecologically reconstructed buildings, a supportive touch urban environment, favorable conditions of life.

The material basis of the formation of the social environment of cities serves the quality of life in the cities: the creation of a harmonious and beautiful city, upbringing a love for the city, the construction of residential houses with high quality living environment, ecological blocks in cities, maintaining communication and

security, environmental services, environmental education and training, environmentally-support design and construction. In terms of infrastructure include environmental building materials, energy-saving and energy-active buildings, reducing system, storage and processing of wastes. Ecological infrastructure includes ecological and economic monitoring, geographic information systems, environmental assessment, indicators supporting development, environmental assessment and monitoring of the building complex. Ecological infrastructure does not include objects of traditional infrastructure (fig. 3).

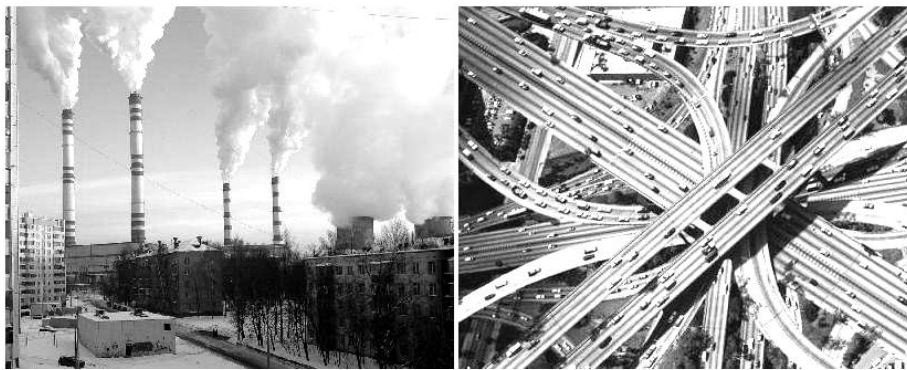


Figure 3. Traditional infrastructure negative for the life of the city

Nature retreats under anthropogenic influence;

researchers propose only one way to restore the ecological balance and the natural environment: to reduce the area of anthropogenic modified and built-up land, return a significant part (about a third used land) «mastered» and the contaminated areas in the natural state. Such return is not possible in condition of perceived growth of urbanized territories and increased the number of mankind. However, in our opinion, this return may be replaced an «elastic», «sustainable», high-quality ecological infrastructure at all levels, integration of urban areas, environmental preserving and nature conservative, nature restoring building, biopositive reconstruction of settlements, buildings and engineering structures that will create a fundamentally new biopositive city and separate objects, related nature, not detached nature and included in natural ecosystems.

This principle makes the actual task of creating high-quality ecologization of the ecological infrastructure, settlements and large areas based on ecological infrastructure, ecological urban renewal and restoration of landscapes: it relates to the preservation of the entire natural environment and, consequently, of life on Earth. It is necessary a long ecological education and upbringing to achieve such a system

and deep ecologization, with a view to establishing a new ecological “noosphere”, the sphere of ecological intellect.

The program of conservation, restoration and protection of the living environment on the basis of ecological infrastructure should be established on the basis of hierarchical system approach. The highest level is a perpetual program for the country, the same programs for large regions and cities. Lower sub-levels for specific cities and regions is the program for sustainable landscapes and ecological balance, environmentally sound dynamic development, environmentally sound consumption of resources and needs.

Ecological infrastructure ensures the preservation and protection of the environment and human life, including in emergency situations and in the catastrophic rise of ecological footprints of mankind. Habitat protection is possible by supporting broad and sustainable ecological infrastructure, and well-founded ecological footprints. Therefore, the most important and ultimate goal of all activities in any country and in any city is to create on the basis of systematic approach and on the basis of ecological infrastructure, using the eco-reconstruction of cities and eco-restoration of landscape, ecological, beautiful and healthy cities located in ecological balance with nature and ensuring residents high quality, environmentally well-founded living environment. This is the most important task of the every State, its decision is linked to the survival of the country, ensuring ecological safety and healthy for future generations.

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