STRATEGY OF COEVOlUTION BETWEEN BIOSPHERE AND SOCIETY: UKRAINEAN DIMENSION

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Abstract: There are dozens of variants to define the term “sustainable development”. It reflects both its complexity and strong interest to this concept. This term has been still debated by the scientists because of the conflicting components “sustainability” (as consistency) and “development” (as dynamic process). From the philosophical and thermodynamic point of view, the development itself is the case of movement associated with growing organizational level of the system and dropping entropy. Simultaneously, the process of moving is a partial element of the development. The purpose of our study was not to clarify this philosophical and scientific contradiction. We suggest that the concept of sustainable development evokes many questions relative methodological instruments and information and energy bases of the system “biosphere –society” to exist, but nothing better is offered by the humanity.

Keywords: biosphere, society, co-evolution, sustainable development, sustainability.

Introduction

The term “sustainable development” is referred to the ideal society standing in the future, which does not yet exist; however, the humanity is trying to work towards creating conditions for sustainable development in all countries including Ukraine. Economists, entrepreneurs and politicians understand the idea of sustainable development as the way of acting without political shocks and radical restructuring of society. We support the concept of classical ecology from the standpoint of synergy (Pytukhina, 2004, p. 83-86; Reymers, 1994, p. 122-156; Khaken, 1980, p. 226-278; Rudyshyn, 2009, p. 67-89) when sustainable development is a shift made by the “society – biosphere” system towards a new quality, that is to co-evolutionary symbiosis between human and nature (Moiseev, 1997, p. 3 – 15; Moiseev, 2001, p. 65-117). We understand it as a managed society development that meets social and economic needs while enabling ecosystems to be self-renewed. Community committed to the sustainable development does not destroy the natural basis biogeocoenoses of biosphere, and provides permanent survival and development of civilization through social and ecological, and economic balance.

The concept of sustainable development implies its being assessed by means of the standards (indicators, indices). To improve environmental management throughout the enterprises the international standard ISO 14001 has been elaborated for the purpose of improving the interaction between three components: production, a product, and the environment (Bellesi, 2005, p. 9-39; Curran, 2004, p. 277-283). The standard is based on the method of “life cycle assessment” (LCA), which consists of inventory of input and output flows of a system producing products (data collection); evaluation of potential impacts on the environment associated with these flows; interpretation of the results obtained through the inventory process and phases of impact assessment. Ukraine is not among those countries that actively implement the standard.

Results

At the international level the indicators of sustainable development are divided into four groups: ecologic, economic, social and institutional. Each group is based on the final statistic data collected through environment monitoring.

Indicators are integrated into the indices of greater complexity - indices of sustainable development. One of the examples of these indices is proposed by international organizations in 2005 index of sustainable development (ESI - 2005). According to the ESI the environmental indicators include quality of air, biological variety, soil, water, and water reserves. In particular, analysis of water quality implies use of the Water Quality indicator which contains four parameters: the concentration of dissolved oxygen, conductivity,
concentration of phosphorus and suspended solids (Rudenko, Biliavskyi, Gorlenko, 2004, p.139-141). These indicators are real step to the optimal development of enterprises in the context of sustainable development.

**Basic causes of Ukrainian ecosystem’s being degraded.** The history of our civilization is a testament to the human desire to change the biosphere and control what a human does not belong. Powerful biogeochemical role is played by a person during mining, fuel combusting, land meliorating and soil exhausting for agriculture, transporting the substances and chemical elements over long distances, creating unnatural urban landscapes, destructing the biodiversity, etc.

Among the main causes of degradation processes in ecosystems Ukrainian scientists call these (Movchan, 2008; Rudyshyn, 2013):

- Changes in spatial characteristics, namely: reduction in the forest area from 50% to 17% having been observed during the historical period; dramatically high level of cultivated land (55% of the state land); woodland belt’s dropping by a quarter;
- Structural and functional changes in ecosystems. In particular, the steppe as the biome was destroyed (only 4% of the heavy fragmented original area has been preserved), floodplain ecosystem were also destroyed; about 80% of wetlands has been drained; small rivers and springs have suffered from degradation;
- Construction of dikes and dams on the rivers (it resulted in substantial violation of migration routes of fish and the destruction of spawning grounds);
- Over-exploitation of marine resources and species as well as introduction strangers caused ten times reduction in fish catch over twenty years (from 70 to 90 years of XX century); exhausting stocks of hunting species and natural plant resources;
- Intensive chemical pollution and the formation of new biogeochemical provinces;
- Changes in landscape areas (scale “irrigation” of the steppe areas with further flooding and salinity, building the huge industrial and energy facilities), which is associated with the further impoverishment of biodiversity.

These examples of environmental problems in Ukraine are not unique. It is important for society to have time to realize that the reduction of the natural landscape and biological diversity to buffer threshold prevents the environment from stability; unfortunately the environment cannot be restored only through the establishment of treatment facilities or transition to low-waste production. Waste are generated in any economic cycle and cause direct or indirect effects that are not eliminated, but merely transferred from one physical and chemical form to another or moved in space. If there is a real opportunity to get rid of waste, it would be a violation of thermodynamic laws of conservation of mass and energy.

**Co-evolutionary strategy of the humanity and biosphere sustainable development.** In the current theory the term “co-evolution” refers to a common development of mankind and the biosphere, which does not display the parameters of the state of the biosphere homeostasis (dynamic equilibrium) and retains the ability of the biosphere to self-organization and self-healing. Co-evolution of civilization and the biosphere preserves the human race as a biopsychosocial type if the natural global ecosystem - biosphere - across the landscape and biological diversity is also saved. The idea of co-evolution justifies the need to restructure the priorities of the person, their consistency with the capacity of nature (Vernadskiy, 2004; Rudyshyn, 2009).

So, the slogan for sustainable development: “If we preserve biological and landscape diversity, then it will save us”. This means that for biosphere to recover, and for the “biosphere –society” to develop sustainably it is more important to save biomes of millions of hectares of natural forests, steppes, wetlands, aquatic ecosystems than just urban ecosystem (metropolis, thousands of kilometers of highways, etc.), and artificial agricultural landscapes crops.

Evidence-based scientific basis of ecological and geochemical calculations and predictions is based on the following considerations. Biosphere is not entropic and capable of self-organization. The main attributes of the biosphere from the standpoint of synergy consideration are: 1) the humanity’s inability to establish strict control over the environment and impose the way of its development; 2) for self-organizing systems there are several ways of development.

For the purpose of scientific forecasting the regulatory capacity of the biosphere to maintain a homeostasis, make calculations based on the fact that:

1. Age of “mature” biosphere is about 200 million years although the phenomenon of life on Earth is about 3.8 billion years, plants emerged on dry land 500 million years ago, which gave rise to produce a coal deposits in particular.
2. We consider age of civilization within 10 thousand years (Babylon, Tripoli). So, for one year humanity uses matter, energy and genetic information that the biosphere has been accumulating for 20 thousand years. If we consider over intensive technological pressure over the past 200 years, then we will see that for one year we burn, destroy, transform and pollute as much as living matter had been creating for nearly 1 million years. This frenetic pace will increase as the world population in 2025 is expected to be at the level of 8.5 – 9 billion (Rudyshyn, 2013, 209).

Building the future of civilization at the expense of food from land and water resources is in doubt because the planet basket thermodynamically designed by nature to one billion people, and this is summarized in the documents of the UN International Conference on the problems of the environment (Rio, 1992) (Rudenko, Biliavskyi, Gorlenko, 2004). In the future, livestock and fisheries will not be able to provide humanity with food (especially protein) for objective reasons: 1) there is the Lindeman environmental rule: only 10% of the energy moves from one trophic level to the next pyramid, which is a consequence of the second law of thermodynamics (Reymers, 1994); 2) the area of the ocean is almost 2.5 times larger than the area of land, but marine ecosystems capture the total solar energy is twice less efficient than land. That is why mankind must move to the autotrophy (by V.I Vernadsky, 2004). Today it is growing the adapted to adverse environmental conditions plants and receiving high-calorie, and high-protein food. Most important for us is to move down to the food chain including the consumption of soy protein, rather than to lose 90% of the energy of food fed to animals.

In recent decades scientists actively discussed two views on overcoming the ecological crisis. Firstly, is the idea of the biological stability of the environment, in terms of biological and landscape diversity of the planet, is sufficient to ensure the stability of the nature to the extent it is able to restore the stability of the biosphere. The reason for the viability of the idea is the claim that the Earth has ecosystems that did not undergo anthropogenic pressure: in Russia about 41% of the territory, in Canada – 65%, in Australia – 33%; in Brazil – 28%; in China – 20%; in Algeria - 64%. In other words, the biota has room for storage and reproduction. So the task of civilization is in all circumstances to prevent the destruction of the biosphere sustainability, store biological and landscape diversity by creating biosphere reserves, ecological network, developing environmental management, using renewable resources (solar, wind, waves, heat Earth, etc.). Scientists suggest that it is urgent to follow the concept of natural “golden average” which mandates the relationship between cultural and natural landscapes at 68% and 32% respectively (Denysyky, 2011, p. 5-10). Establish one’s own “golden average” according to scientists is not prospective idea.

Secondly, we should consider the idea of “joining” the natural cycle of humanity. The reason is the opposite assertion that the biota of the planet has no reserves, all ecosystems directly or indirectly are degraded (reduced biological and landscape diversity, altered species composition of ecosystems, climatic conditions, etc.). It is reasonable to rationally use the natural resources in order to extend the term of their use; bring younger generation up with the positive attitude towards the natural environment. In our opinion, the time is to combine these two areas based on co-evolutionary paradigm of sustainable social and economic development of the “society – biosphere”. It should shift emphasis from “nature security” to regulation of artificial environment. To do this, it should be created: 1) the international governing body of the Environment and Sustainable Development on the planet with the relevant organizational and financial, supervisory and regulatory functions; 2) International Centre for monitoring, the global network of monitoring stations, landfills, regional and national monitoring centers (for control “resuscitation” of the biosphere), international standard indicators of the environment and sustainable development.

Environmental network, biological and landscape diversity as conditions of sustainable development.

Environmental network is a system of biotypes (areas of biomes) that are connected in space at local, regional or other levels, has legal status and restores biogeocenosis cover of the territory (Rudyshyn, 2013).

Theory and practice of creation of ecological networks are based on the ability of natural ecosystems to self-regulation, self-healing and to adapt to the development that maintains homeostasis with ecosystem. This provides only autotrophic component of the system, which is able to produce organic matter for biodiversity of consummates at all other levels (including human level). The general trend in the conceptual approach to ecological network is to try to create an optimal social and natural system that would solve the problem of protecting the existing biota taxa, and would provide a range of services to the population (social, economic, aesthetic, and recreational, etc.).
In terms of establishing a biogeocenosis ecological network, it improves the environmental status of the region, results in stabilization of the hydrological regime, stops erosion, reduces pollution, improves soil conservation of renewable resources, and maintains the balance of natural processes.

Fundamentality of the idea of creation of ecological network, as well as biodiversity, is to ensure or restore biogeochemical cycles at biogeocenosis, biomes and the biosphere. The fact that natural area is supported with the components of biogeocenosis cover to ensure the transformation of solar energy into chemical bonds of organic compounds, stable cycles of biogenic elements and their compounds, homeostasis of the biosphere and its hierarchical elements (Grodzinskyi, 2010, p. 1-3; Movchan, 2008).

The main threads of the ecological network - corridors – are relatively unbreakable strips and tracts of natural biotypes (saved or restored). These “threads” (natural corridors), “cores” and “nodes” (the intersection of natural corridors) should be protected by the buffer areas (existing, created or restored). Width of corridors depends on the status of ecological network, and can be from tens of meters (locally) to kilometers (at the national or European level).

So, to stop the destructive processes and achieve ecological balance the natural framework in Ukraine by increasing the areas of ecological network and recovered (healed) landscapes need to be restored. In Ukraine, scientists developed a national program of the National Ecological Network in Ukraine for 2000-2015, which was approved by law (Law of Ukraine as of 09.21.00, № 1989-III). It involves that the total land of ecological network in 2015 will go up to 41 - 68% (25164.5 thousand hectares) of the total area of Ukraine, and the area of nature reserve fund - to 10.4 % (6275 thousand hectares).

The ecological network of Ukraine is to include (Movchan, 2008):
1) natural areas which concentrate existing or new objects of natural reserve funds (Azov, Donetsk and Azov, West Polisskyy, Carpathians, Crimea mountain, Nyzhnodnistrovskyy, Nyzhnodunaiskyy, Podolskyy, Prydonskyy, Serednodniprovskyy, East Polisskyy, Tauride, Central Polisskyy, Black Sea);
2) the main elements of the national ecological network communications including: a) corridors at latitude (provide natural connections); Polisskyy (forest area), Galicia- Slobozhansky (forest area) and South (Steppe zone), coastal-marine (coastal strip of the Azov and Black Seas), b) meridian natural corridors (combined water and floodplain landscapes in spacious valleys of large rivers); Dneprovskyy (Dnipro river Valley), Dnisterovskyy (Dnistro river Valley), Buzskyy (river valleys of Western and Southern Buh), Seversky -Donetskyy, Severskyy Donets river Valley).

In the formation of the ecological network a prominence place is given to its core - protected objects that have different meanings and status. The highest status is given to the cross boundary biosphere reserve (CBR), to which UNESCO program “Human and Biosphere” grants certificate to confirm its status of park (national or regional) that is legally protected.

Today in Ukraine there are six Biosphere Reserves, five of which are located on the border with other countries and are the basis for creation of CBR. Exchange of experience and cooperation enable more efficient solving the administrative and organizational, scientific, social and economic, cultural and tourist problems. In particular, based on two Biosphere Reserves (Ukrainian and Romanian) in the delta of the Danube River in 1991 the CBR “Danube Delta”, which is crucial for maintaining wetland ecosystem with a unique composition of biodiversity, was created. Based on the Polish- Slovak biosphere reserve the trilateral CBR “Eastern Carpathians”, which covers an area of 213.2 hectares was developed in 1998 with the participation of Ukraine. The value of this object is the preservation of forest ecosystems, such as beech and fir proflies, grass and other types of groups.

The trilateral CBR “West Plessey” was established on the territory of Ukraine, Poland and Belarus. The value of this reserve is to preserve the landscape of the region and karst lakes system including the deepest - Svitiaz. Several CBR will be created on the verge of Ukraine and Russia, Ukraine and Belarus, Ukraine and Moldova.

Establishing an ecological network actually improves the condition biogeocenosis of Ukraine due to: stabilization of the hydrological regime (protection of surface and groundwater), stop of erosion, improvement of soil, conservation of renewable resources, maintenance of the balance in the natural processes, support of the natural migration of species and biota, reduction in pollution of the environment. However, we can expect positive changes in social and economic plan: historic preservation and development of environmentally friendly forms of farming (apiculture, fish farming, organic animal husbandry, and
horticulture), optimization of the use of different areas and their spatial location in the environmental context, creation of comfortable for health living conditions.

Discussion

Today there is no an alternative to the concept of sustainable development. Co-evolutionary paradigm is a theoretical and methodological basis for sustainable development of the “biosphere – society” system that is possible through creating the biosphere reserves, ecological network, reserve management, and use of renewable resources (solar, wind, wave, geothermal). It is important for society to have time to realize that the reduction of the natural landscape and biological diversity to buffer threshold value eliminates the stability of the environment that can be restored only through the creation of sewage treatment plants, low-waste production or organic farming. It is advisable to stick to the concept of natural “golden average”, which mandates the relationship between cultural and natural landscapes of the planet at 68 % and 32 % respectively. Humanity must go to the autotrophy. Today it is growing the adapted to adverse environmental conditions plants and receiving high-calorie, high-protein foods. The most important fact is that a human is destined to go down the food chain including the consumption of soy protein rather than to lose 90 % of the energy of food to feed the animals.

References


