

# New Challenges in Sustainable Development for Russia and the World



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Edited by

Victor I. Danilov-Danilyan  
and Natalia A. Piskulova

Cambridge  
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**Editors:** Victor I. Danilov-Danilyan and Natalia A. Piskulova

**Contributors:** Professor V.I. Danilov-Danilyan, Corresponding Member of the Russian Academy of Sciences, Doctor of Economics (Chapters 1, 2); Professor S.N. Bobylev, Honoured Master of Science, Doctor of Economics (Chapters 3, 10); Professor N.A. Piskulova, Doctor of Economics (Chapters 4,7); Associate Professor A.V. Abramova, PhD, Economics (Chapter 4); G.V. Safonov, PhD, Economics (Chapter 6); A.A. Averchenkov, PhD, Economics (Chapter 5); A.O. Kokorin, PhD, Physics and Mathematics (Chapter 5); A.A. Averchenkova, PhD in Economics and International Development; Professor V.M. Zakharov, Corresponding Member of the Russian Academy of Sciences, Doctor of Biological Science (Chapter 8); Professor E.V. Nikonorova, Doctor of Philosophical Science (Chapter 9).

**Translation:** V.N. Kuryakov, N. D. Kuznetsova

This book first published 2018

Cambridge Scholars Publishing

Lady Stephenson Library, Newcastle upon Tyne, NE6 2PA, UK

British Library Cataloguing in Publication Data

A catalogue record for this book is available from the British Library

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ISBN (10): 1-5275-0936-2

ISBN (13): 978-1-5275-0936-8



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## ACKNOWLEDGMENTS

This book would not have been possible without the support of Moscow State Institute of International Relations (University).

Many people have contributed time and effort to the book, and we would like to thank all of them for their impressive scholarly work and comments. We thank our translators Valeriy Kuryakov and Natalya Kuznetsova for assistance with the translation of this book. We would also like to show our gratitude to Marina Petrova for the support during the course of the publication of the book.

We are particularly grateful for the encouragement and continuous support of the Vice-Rector of MGIMO-University Artem Malgin, who helped to facilitate the writing and publication of the book.

Victor I. Danilov-Daniliyan, Director of the RAS Water Problems Institute  
Natalia A. Piskulova, MGIMO-University



# INTRODUCTION

Global environmental problems interconnected with social issues are recognized today as the most important for humankind. Attempts to find a way to resolve them led to the creation of the sustainable development concept during the 1980s and, later, to the first steps in its implementation. Sustainable development is one of the goals of leading international organizations, for example the UN, World Bank, World Trade Organization, etc. Likewise, it is on the list of goals of regional integration agreements (EU, NAFTA, etc.) and of individual countries. Practically all of the UN millennium development goals are closely intertwined with the implementation of the concept.

Initially, the idea of sustainable development was mostly regarded as an obstacle to world progress. It was understood, first of all, in accordance with economic theories from the eighteenth century to about 1972 and adopted by big businesses. Such understanding brings economic development down to the narrow quantitative aspect, reflecting the growth of traditional macroeconomic indicators (GDP, first and foremost). However, subsequently, especially with the emergence of economic growth quality concepts, the sustainable development idea was becoming more and more recognized as an incentive for economic growth. During recent years, the concept has received a fresh impetus due to growing academic consensus on climate changes resulting from the use of fossil energies by mankind, from the financial and economic crisis of the first decade of the twenty-first century and from the recognition of the scarcity of natural resources and increases in the prices of food and raw materials, which causes suffering for the most impoverished population groups. The implementation of sustainable development ideas is beginning to involve all players in international relations more actively: international organizations, governments, businesses, public organizations, educational institutions and individuals.

Moscow State Institute of International Relations (MGIMO-University) is also contributing to teaching and research on the subject. Taking into account the growth in demand for experts in the field of sustainable development, the university curricula include environmental, economic and social subjects. In its teaching, the university pays special attention to the international aspects of the implementation of the sustainable

development concept. It is exactly these aspects that the authors have attempted to present in this handbook.

The handbook structure has been discussed among authoritative experts in the field of sustainable development. The edition does not pretend to cover all aspects of a subject as wide as sustainable development exhaustively, taking into account the fact that sustainable development issues are of an interdisciplinary nature and are still under active research. At the same time, the handbook is innovative and multidimensional and covers the basic issues of sustainable development; it also touches on those that could be of interest in the future. The book presents the basic ideas of global environmental problems and the concept of sustainable development, highlights trends in “green” economy progress (the theory of which is still under research), describes climate policies, covers issues of the international community, and the involvement of governments and businesses in the implementation of the concept and analyzes its social and gender aspects. Special attention is paid to the specifics of the implementation of the sustainable development concept in Russia.

For the convenience of the readers, the text has boxes with basic notions and examples that confirm the main points presented in the book.

The authors hope that the handbook has resulted in an interesting and modern approach and that it will spark interest in further studies on sustainable development and green economy issues.

## CHAPTER ONE

# GLOBAL PROBLEMS OF THE MODERN AGE

V.I. DANILOV-DANILIYAN

### **1.1. The notion and essence of global problems**

The term “global problems” is a commonly used term for a number of issues caused by modern civilization; those problems condition the sustainability of its development and, moreover, its survival. First, global problems are caused by global trends of human progress in modern times, i.e. by actions that involved practically all of humankind during the twentieth century, although originally they were directed by socioeconomic behavior stereotypes and value settings that dominated in western European countries; second, they are of principal importance for the development of all and everyone; third, their resolution requires coordinated effort by all countries and nations of the world. The existence of global problems was recognized in the mid-1960s; at the same time, they became the subject of scientific research and large-scale discussions in the developed countries and in the USSR, and during the subsequent decade they also became subjects of discussion in the third world. There are many definitions of the term *global problems* (practically all of them specify the general definition given here differently) and synonymous terms (universal, panhuman, worldwide, planetary problems, global problems of humankind, global problems of civilization, etc.). There are also different classifications of global problems, but none of them meets the criteria of completeness and logical rigor.

Historically, the first global problem that attracted the attention of the public, politicians and researchers was the *threat of a nuclear war*. Although a full picture of the consequences of a large-scale nuclear war still remains unclear, there is no doubt that the use of even fifty percent of accumulated nuclear arsenals would bring about the end of this civilization. The 1962 Cuban missile crisis which brought the world to the brink of a nuclear conflict between the USSR and the USA became an

incentive for a heightened perception of the threat, but the analysis of the reasons for and mechanism of its development led to the understanding of still another global problem—the arms race—and revealed a close interconnection between the two problems. The attempts to resolve the nuclear threat and arms race issues led to the conclusion of a number of international agreements that provided grounds for believing that significant progress had been made in resolving these two global problems. However, production of nuclear weapons in a number of countries that have not joined the non-proliferation treaty, as well as the production of other types of weapons of mass destruction, rapid growth of an arms market where active buyers are countries that are not parties to any limiting international agreements, have weakened the stability of the world community due to the destruction of its bipolar structure (1991); the growth of international terrorism conditioned a more modest evaluation of the significance of that progress. Following the September 11, 2001 terrorist attacks in the USA (when the danger from international terrorist networks and organizations became absolutely clear) international terrorism is now regarded as one of the most burning global problems.

Studies of global problems related to the military aspects of the existence of modern civilization inevitably led to raising the issue of their economic and social causes as well as their consequences. Accordingly, the great gap in the development and wellbeing levels between different countries and regions and massive poverty in developing countries were recognized as global socioeconomic problems. These factors could become the strongest destabilizers of the global political situation, although originally they were only apparent on a national or regional scale. The *demographic explosion* closely interrelated with other global problems played a significant role in the emergence of global socioeconomic problems. Control of demographic growth is regarded not only as an individual global problem but also as a means to resolve at least some others. According to certain forecasts, growth of the world's population will continue until the middle of the twenty-first century and the demographic factor will remain one of the most significant in all global processes not only until the population number stabilizes but possibly during a certain period thereafter.

## **1.2. Sources of global problems**

Degradation of the environment at sites of environment-intensive industrial enterprises and intensive agriculture provided an impetus not only for regional, but also global environmental studies. The “Limits to

Growth” report to the Roman Club (1972, Chapter 2) highlighted another global problem—the environmental one. The specific feature of the threat from the problem means that as a result of excessive anthropogenic pressure the biosphere could transit to a state that would be incompatible with the survival of civilization. Later it became clear that the above global problem represents a whole range of interconnected problems that will be described below in greater detail.

The world energy crisis of 1973-1974 significantly exacerbated the issue of providing the world economy with natural resources and predetermined that the global resources problem would be raised. However, the analysis of the problem and the practices of the late twentieth century and the early years of the twenty-first century demonstrated that the market system reacted rather flexibly to the real and potential (in the near future) deficit of resources. Scientific and technological progress was oriented at resource-efficient technologies and replacement of scarce resources; and long-term state regulation basically coped with resource problems (although competition and rivalry for natural resources not only often caused conflicts between individual countries but sometimes exacerbated the international situation).

The known exception is the consumption of fresh water on a tremendous and ever-growing scale by agriculture, utilities and industry. Fresh water cannot be replaced in most of its uses and is reproduced in ever declining volumes, because growing anthropogenic effects undermine the natural processes of its reproduction. The relevance of the fresh water global deficit problem is determined exactly by the fact that it combines two aspects—the resource aspect and the environmental one.

A number of pressing problems for many developing countries are often referred to as global problems; these include food deficit, massive unemployment (especially among youth), unsatisfactory state of education and healthcare systems, deplorable sanitation, growing occurrence of AIDS, tuberculosis and other diseases that spread largely due to social factors, etc. Methodologically, however, it would be more correct to regard those problems as manifestations (and consequences) of global problems such as poverty and the gap between socioeconomic development levels. Within this group of regional (or national) problems, public health issues stand out. These issues are specific to developing countries, but the public health issue *per se* is very relevant for the developed countries too, although it is manifested there in a different way (massive over-nutrition and resulting pathologies, growth in the incidences of mental illnesses, suicide, etc.). Certain phenomena from that sphere are characteristic for both developed and developing countries (growth in the

number of newborns with genetic anomalies, increase in drug addiction, spread of AIDS epidemic, etc.). That is why quite rightfully we can regard the health problems of the general population (public) as a global problem.

The global problems highlight the controversies in the development of modern civilization—the controversy between civilization and nature, between different civilization components, between the demand for resources and the potential to satisfy it, between the needs of the current generation and the necessity to provide conditions for generation reproduction. Research and attempts to find ways to resolve the global problems lead to raising the issue of their origins. Neo-Malthusianism attaches special significance to the demographic problem declaring it a source of all other global problems. The generalized Neo-Malthusian approach can be considered as a “zero growth” concept (ascending to the “Limits to Growth” report) that suggests resolving resource and environmental problems at the cost of giving up economic expansion. However, at the current phase of civilization development, the orientation to high (or low) birth rate and economic behavior is determined not only by outside factors—socioeconomic conditions of a person’s life but also by his/her mentality. Value systems, behavior stereotypes and pragmatic orientations determine the choice every time where an individual has an opportunity to make a choice. At the same time, rational behavior directly depends on the education level, self-sufficiency and individual choice orientation.

It is exactly these qualities that were cultivated among Europeans of the modern epoch (i.e. beginning from the Age of Enlightenment) which allowed Europeans to achieve economic, science and technological successes unimaginable in previous civilizations (although a certain continuity is evident between modernity and Greco-Roman Antiquities). But blind faith in knowledge (*a priori* incomplete!) and orientation at individualism in decision-making, intensified the development in those aspects that had determined the emergence of global problems such as excessive load on the environment; depletion of natural resources; tremendous difference in growth rates between countries involved in the economic race, on the one hand, and those who were late to join it, on the other hand; competition for resources and markets with the trend of economic controversies evolving into armed conflicts; etc. The degree of rationality, justification and legitimacy of decisions made at different social structure levels—from an individual to a government—is approximately the same, but there is a tremendous difference in the risks related to wrong decisions. That is why the way to overcome the differences reflected in the global problems presupposes, first and foremost, changes in the individual *per se* and in the social structures.

Such changes are continuous; the question is whether they correlate with the goals of resolving the global problems. The necessary changes in human perception cannot occur on their own or, for example, under the influence of the market. To occur in conditions of globalization they require consistent and coordinated action from all countries. Contemporary means of influencing popular consciousness, unknown in previous epochs and extremely efficient, are almost all commercialized (even if they are state owned). It is difficult to assess the consequences of the phenomenon, but there is no doubt that the modern individual lives under conditions of colossal information overload. As far as the effect of mass culture, show business, professional sports, etc. over consciousness is concerned, the assessments of different researchers diverge very significantly. For example, according to some researchers, the showing of violent scenes on TV leads to imitative behavior among a significant number of viewers contributing to growth in the crime rate. According to others, it mitigates aggression by transferring it to the virtual world. One way or the other, the effect of information stress and mass culture on public consciousness constitute another global problem. Cultivation of qualities such as a desire for dialog and compromise, orientation at long-term goals, respect for other cultures and confessions, solicitous attitude to the biosphere as the only home for mankind is recognized by many researchers as the main means for resolving global problems (in the spirit of concepts of environmental ethics). At the same time, scientific, technical and economic means are declared as necessary but subordinate.

Nowadays, the design and effective use by civilization of different means to resolve known and new, emerging global problems is considered as a transition to sustainable development. No doubt, the very emergence of the sustainable development concept was caused by the extreme importance of the realization of global problems and by the search for ways to resolve them. At the same time, understanding the essence of global problems deepened alongside the concept perfection process, although it was the global environmental problems that had provided an impetus for its emergence during the late 1980s. Moreover, today, almost thirty years later, for many people sustainable development remains an attempt to find ways to resolve only environmental problems, although it is impossible to separate them from other modern global problems and to resolve them in isolation from other global problems. Keeping in mind the special role of environmental problems in the emergence and maturing of the sustainable development concept, they deserve a more detailed analysis.

### 1.3. Major global environmental problems

As was noted above, the term *global environmental problems*, is a common term for the problems that have emerged as a consequence of the excessive influence of civilization on the biosphere. As a result, there appeared a threat that the environment would lose the qualities of sustainability and that it would transit to a state incompatible with the existence of civilization or, in any case, to a condition that would correspond to humankind's needs to a much lesser degree than the modern condition. During the second half of the twentieth century, the changes observed in the atmosphere, water bodies, soils, flora, fauna and climatic system acquired a global scale. During the late 1960s, concern that the growing anthropogenic pressure on the biosphere could bring about catastrophic consequences emerged, although the emergence of the environmental imbalance and intensification mechanisms were absolutely unclear.

Depletion of the *ozone layer* became the first real problem. That phenomenon was discovered by stratosphere satellite monitoring; the ozonosphere screens the Earth's surface from the hard X-rays of the Sun, which are lethal and dangerous for many species of living organisms, including human beings and domestic animals. It was established that the stratospheric ozone can be destroyed by man-made substances, namely chlorofluorocarbons. The world community managed to come to an agreement to stop the production and use of ozone-degrading substances (the Montreal Protocol of 1987). By 2007, the prescribed measures had been fully implemented in practice. Observations demonstrate that depletion of the ozone layer has slowed significantly and, most likely, once the chlorofluorocarbon molecules emitted into the atmosphere earlier have fully degraded (which takes several decades), will stop completely, at least for anthropogenic reasons. For the time being, the ozone problem is the only global environmental problem for which humankind has managed to find and implement an effective strategy. This is explained by the fact that the problem is practically independent of others and its emergence was conditioned by a very narrow sector of current human activities, i.e. production and use of chlorofluorocarbons.

The precedents of *biodiversity shrinkage* caused by expanding human economic activities were recorded as far back as the late eighteenth century. However, it was only during the 1970s that the real scale of the process became evident: according to current estimates, at present biodiversity is shrinking at a rate that is 100-1000 times higher than during any of the previous epochs when the process was conditioned by natural reasons only. It was also recognized that biodiversity is important for the

balance of the global environment and is supported by the diversity of ecosystems, and the latter, in its turn, is supported by species diversity, which is the only guarantee for the regeneration of ecosystem processes if they are disrupted by certain disturbing effects of natural or anthropogenic factors. Basically, diversity (of elements, processes, states, etc.) is a necessary condition of stability in any complex system that functions (exists) in a fluid and changing environment. It is absolutely true for the biota—the system of living organisms that inhabit the Earth. The regeneration potential can turn out to be insufficient for suppressing the consequences of significant disturbances and returning to the original balanced condition, and then the species formation process intensifies (basically, it is continuous), biota restructuring takes place, initiating its new (ecosystem, species, intra- species, etc.) structure and the search for a fresh balance between the biota and the environment. Biodiversity also plays a key role in that process because it is not only the biota regeneration potential that it determines.

The UN Convention on Biological Diversity developed in 1992 came into force in the mid-1990s; however, unlike the Montreal Protocol, it is a framework document and does not prescribe any rigid commitments or measures for member countries. The difference with the ozone layer depletion problem is of principal importance: to resolve the problem of biodiversity shrinkage it is absolutely not sufficient to take measures in a narrow field (as in the case of ozone-degrading substances); the anthropogenic effect on the biosphere must be reduced through the entire range of human economic activities; the specifics in different countries and economy sectors are so deep and varied that it is impossible even to systemize them and compare potential measures in terms of costs and results. Apparently, the biodiversity shrinkage problem is the most complicated among all global environmental problems: it is the least susceptible to quantitative analysis and the forecast of the development and consequences of that process is intertwined with all other global environmental problems and is related to all aspects of human life and activities.

Of greatest concern for the world, is the global climate change problem. As far back as 1896, a Swedish physicist S.A. Arrhenius suggested the hypothesis of the greenhouse effect and, accordingly, of potential global warming due to growing concentrations of greenhouse gases in the atmosphere because of carbon dioxide emissions produced by burning organic fuels. Meteorological monitoring data for a period of about 150 years demonstrate that global warming expressed in terms of global average near-surface temperature is really occurring. However,

climate was changing during previous epochs too, so it was necessary to research the reasons for warming. The twentieth century studies identified still other anthropogenic effects on the climate system (apart from carbon dioxide and other greenhouse gas emissions): replacement of natural ecosystems by agrophytocenosis, by urbanized territories, etc., and, as a consequence, changes in moisture circulation over land and in the distribution of land sections reflection capability (albedo); deforestation and marshland reclamation that result in the reduction of carbon dioxide absorption and carbon sequestration by ecosystems. Significant success has been achieved in building climate system models that consider many other factors. The research results allow sufficiently high confidence in claims that the anthropogenic factors account for a dominant share in the contribution to recorded global warming, although the significance of nature-related causes is also material. The validity of that assertion is growing with each year (as the periods of climate monitoring are becoming longer).

Most disturbing is the fact that global warming is occurring very rapidly. There were similar rates of climatic changes during previous geological times too, but that fact should by no means be regarded as an argument substantiating the absence of serious danger for survival of the planet's biota. The existing biota, apparently, cannot adapt to such rates of climatic changes if those rates do not slow significantly and if the current anthropogenic shifts in the biota (biodiversity shrinkage, first of all) progress far enough. The fact is that previous climatic changes were met by a "healthy" biota and they were the only disturbance for it (in any case, dominating disturbance); the existing biota is experiencing extreme anthropogenic disturbance even without climatic changes and an additional load for its adaptability potential could be really lethal.

Furthermore, global climate change warming is manifested in the change of precipitation regime, frequency and intensity of different weather and climate anomalies (floods, droughts, hurricanes, tornados, huge temperature swings, etc.). Warming and other changes occur unevenly in time and space with probable regional effects (including cold spells). In their totality, climate changes are already causing tremendous damage that will inevitably grow significantly in the twenty-first century under any probability of the process evolution. The trends and principles of action to mitigate climate changes and their consequences have been declared by the UN Framework Convention on Climate Change (UNFCCC, developed in 1992, came into force in 1993), that prescribed in detail the necessary measures (up to developed countries' commitments to limit greenhouse gas emissions during the 2008-2012 period) and in the Kyoto Protocol

(developed in 1997, came into force in 2005). Essentially, it is a pilot agreement aimed at perfecting cooperation mechanisms of countries to achieve UNFCCC goals in future: to stabilize the concentration of greenhouse gases in the atmosphere at a level that is safe for the climate system. The USA signed but did not ratify the Kyoto Protocol because it believes that the greenhouse gas emissions prescribed for the country are too burdensome for the American economy. Despite all the difficulties, agreement regarding continuation of the Kyoto process after 2012 has been reached and intensive consultations are in progress concerning an agreement for the period after 2020 (see Chapter 5).

The global scale of dangerous processes caused by anthropogenic reasons include *desertification*, *soil depletion* and shrinkage of forested areas (*deforestation*). They are of extreme importance for biodiversity and cause disruptions in regional environmental balance thus influencing the global environmental balance, too. Desertification and soil depletion cause colossal damage to agriculture and other sectors of the economy.

One particular environmental problem is the global chemical pollution of the biosphere. Man has learned to synthesize about fifteen million chemical substances; more than 100,000 substances are used commercially, but standard toxicological characteristics are known for less than one percent of them and reliable toxicity data for eighty percent of the substances used is not available at all. For many substances (for instance, highly toxic heavy metals) the mass that man has introduced into the biogeochemical turnover is orders of magnitude greater than the mass involved in the natural turnover.

Frequently, the deficit and depletion problems of natural resources (fossils, bio resources and fresh water) are referred to as global environmental problems. This is true only regarding the degree to which resource availability depends on the condition of the environment. Such a dependence is not significant in the case of non-renewable resources (fossils, for example), but it is important for bio resources (although in that case the main threat is overharvesting) and critical for fresh water. Natural regeneration processes of fresh water resources depend on already mentioned global environmental problems, such as chemical pollution, deforestation, desertification and overuse of water resources.

There is only one way to resolve global environmental problems—reduce the anthropogenic effect to a level that does not degrade biosphere capability to reproduce a healthy environment. This can be achieved through making production environmentally friendly, through rational consumption, which, in turn, is achievable only with changes in the system of human values, in activities orientation and in behavior stereotypes.

The above conclusion (regarding the necessity to introduce changes to human consciousness) is equally true for all environmental problems. However, in the contemporary world, reasonable changes in public consciousness will never occur all by themselves. Their occurrence requires planned, continuous and targeted work both in the spheres of upbringing, culture, education and in the material sphere. Progressive shifts in the material sphere are as important. In the long run, it is they that will reduce environmental effects and provide fair wellbeing for all inhabitants of the Earth. They are also the most important component in upbringing and education because without them all the talk will be taken as detached from real life. The sustainable development concept is a theoretical basis for action aimed at resolving current global problems in both the spiritual and material spheres.

### References

1. Environmental Encyclopedia. Six volumes. Chief Editor V. I. Danilov-Daniliyan. Moscow: Encyclopedia, 2008-2013.
2. Gvishiany, D. M. *Bridges into Future*. Second edition. Moscow: Editorial URSS, 2010.
3. Peccei, A. *Human Qualities* (Translated from English). Moscow: Progress, 1985.

## CHAPTER TWO

# SUSTAINABLE DEVELOPMENT CONCEPT: ESSENCE, PRINCIPLES, METHODOLOGY

V.I. DANILOV-DANILIYAN

### **2.1. Emergence of the *sustainable development* notion**

The English term *sustainable development* originally appeared in the environmental management sphere. Canadian fisheries management experts were the first to use the collocation in the mid-twentieth century. They used the term to name a fish resources exploitation system under which the resources are not depleted and the catch does not exceed the capability of simple fish population reproduction. But even one hundred years before the Canadian fisheries experts, the same idea (applied to other resources and in another language) was suggested by German foresters: they meant a forest exploitation system under which forests are preserved, cuttings do not exceed natural recruitment and harvest areas are organized in such a way that the forest ecosystem reproduces itself without any loss (using present-day terminology). Under such a system (in both fisheries and forestry) exploitation of resources can continue indefinitely if not disrupted by outside factors unrelated to natural resources management. The adjective *sustainable* emphasizes stability alongside with the long duration of the process, i.e. the process is sustained in a way that allows continuous reproduction of its important qualities.

From natural resources management where it was used with clear orientation at local ecosystems, the term *sustainable development* migrated to global ecology. Since the 1980s, it has been used in science but became more widely used after the “Our Common Future” report<sup>1</sup> prepared in 1987 by the World Commission on Environment and Development (WCED) established by the UN four years earlier to study the problem of

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<sup>1</sup> Our Common Future. UN, N.Y., 1987.

interaction between nature and the human community, environmental consequences of the anthropogenic effect on nature and ways to mitigate those consequences. WCED was established because about ten years after the United Nations Conference on the Human Environment (also known as the Stockholm Conference) that was held by the UN in Stockholm in 1972, it became clear that the world was not developing as it should have been developing in accordance with the decisions of the Conference. The Commission was assigned the following mission: to clarify the situation, to assess the trends and, if possible, to formulate certain constructive proposals. The Commission proceeded from the basic provision formulated (albeit in different terms) as far back as Stockholm: sustainability in the environmental aspect is inseparable from world development sustainability understood in a broad sense. The report of the Commission suggested the following definition: “*Sustainable development is the development that meets the needs of the present without compromising the ability of future generations to meet their own need.*”<sup>2</sup>

Box 2.1. WCED included famous scientists, politicians and public figures. It was headed by a Norwegian politician Mrs Gro Harlem Brundtland who had great experience working as Norwegian Environment Minister in 1974-1979 (Mrs Brundtland was also Norwegian Prime Minister in 1981, 1986-1989 and 1990-1996, and in 1998-2003 she was World Health Organization General Director), so WCED is frequently called the *Brundtland Commission*. The Commission discussed its goals at open conferences in many countries. “Our Common Future” report was translated into all UN official languages and many other languages. Different components of the world community—politicians, journalists, scientists—received new food for reflection and discussion: the notion of *sustainable development* and appeal to the world community to achieve transit to it.

As the *sustainable development* notion was becoming common to the public consciousness, the discussions of its essence were predominantly theoretical. However, in 1992 the Conference on Environment and Development was held in Rio de Janeiro. It was the largest world forum of the last quarter of the twentieth century, and in its decisions *sustainable development* became the key term (essentially, establishment of WCED and its mission to prepare an analytical report were one of the measures in preparation for the Conference). Agenda 21, Rio’s fundamental document, was structured in such a way that all problems of the new age were

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<sup>2</sup> Our Common Future. UN, N.Y., 1987.

concentrated around sustainable development. It was not only environmental problems that were concerned, because it was no longer necessary to convince anybody that emergence, aggravation and methods of resolving environmental problems could not be considered outside the all-encompassing socioeconomic context and that it is in economics and society that one should look both for their causes and the means to mitigate if not to resolve them.

After Rio, the period of quiet academic discussions was over—every politician had to decide on his/her attitude to the issue, and that attitude became a significant factor in the interaction with the electorate. Scientists dealing with the subject and many persons far remote from it sensed a strong social mandate and engaged themselves in studying the problem. Frequently, those studies consisted of scouring archives for mathematical models that could at least superficially appear to be applicable for measuring sustainability; after reshaping definitions and equations one could quickly obtain results that were quite usable in reports to international symposia. Of course, there were also many serious works, maybe too many, so there was frequently a feeling of being lost among those who wanted to understand the essence of the issue. Journalists sticking to politicians started to learn about the new issues and were actively interviewing officials and politicians, but the attempts to describe the answers in an understandable language led to the situation where the “general public” that was initially interested in the sustainable development idea gave it the cold shoulder. Gradually, for many people *sustainable development* became a “buzzword” used too frequently without any understanding of what it means or could mean; it is just modern fashionable jargon and nothing more. However, in the practical work of all international organizations, government bodies of many countries, European Union Member States, China, Japan, USA, Canada the *sustainable development* notion became one of the fundamental notions not only in environmental activities but also in the development of all large-scale economic and social programs and projects, especially long-term ones.

Moreover, use of the notion of *sustainable development* is expanding continuously, both in terms of geography (because more and more countries are using UN-developed sustainability assessment methods to analyze economic and social development, conditions of the environment, etc.) and in terms of contents that is continuously expanding to cover new aspects of civilization development. For example, after the terrorist attacks in New York on September 11, 2001, the problems of preventing terrorist activities and combating terrorism became an important sustainability

issue. This is one good reason to find the underlying cause of the *sustainable development* notion and of the concept that is being developed based on it.

The original definition of the *sustainable development* notion given in the WCED report caused a wave of criticism and a desire to improve it. There are hundreds of publications that contain attempts to modify the original definition or suggest a new one. However, after more than a quarter of a century long efforts by researchers from many national schools failed to produce a generally recognized definition.

The definition of the *sustainable development* notion given in the WCED report causes doubt first of all in connection with the “ability of future generations to meet their own needs.” It is not clear what needs are meant: is it necessary to account for the so-called induced needs, i.e. the needs that are not rooted in humanity and necessity for all-round harmonious development of a person, but the needs imposed on a person with one and only one goal—to generate a profit for producers, developers and sellers of certain products? (Let us note that there are no criteria to clearly distinguish between “true” and “induced” needs.) There is no clarity concerning the methods to satisfy those needs, even if the needs themselves are recognized as known (for example, permanent needs as they are today or “adjusted” needs, at least slightly upgraded to the level of not the richest but not poverty-stricken countries—in those countries that are considered poor). What does “without compromising the ability of future generations” mean? What time horizons should such assessments cover? There are no convincing clarification attempts either in the Brundtland Commission report or in the great number of international documents published later.

Neither are there such attempts in “Agenda 21,”<sup>3</sup> which more or less touches upon all world problems thoroughly (environment, poverty, differentiation of countries according to living standards, resources deficit, gender equality, upbringing and education, expanding drug addiction, etc.—everything that was widely discussed during the late 1980s and early 1990s). “Agenda 21” in raising all those issues, emphasizing their interrelation and planning certain steps to resolve them is, without any doubt, a positive moment of that and other documents of the Rio de Janeiro Conference (1992) and subsequent summits (“Rio+10” in Johannesburg, 2002, “Rio+20” again in Rio de Janeiro, 2012) and of many smaller conferences. However, the problems are not systemized, their interrelations are inadequately identified, common roots are not emphasized, a common

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<sup>3</sup> See UN website.

methodological basis is not established for them, and that is why adequate approaches to their resolution have not been found. The implication of “Agenda 21” is as follows: if we manage to resolve all the global problems raised, it will be actual sustainable development; and if the problems remain unresolved, the development of civilization will be, at least partially, unsustainable and the global crisis will deepen further.

The lack of a generally recognized *sustainable development* notion definition is the reason for continuing discussions. However, the differences are conditioned not only by the fact that the subject is inadequately outlined, because it is clear that, whatever definition is fixed, many shall nevertheless interpret the subject “in their own way.” The point is also in the treatment of the notion’s content and its scale.

Box 2.2. Very often, the discussions of sustainable development mutate into arguments about the choice of words. The Russian translation of the English word combination *sustainable development* is criticized (and really, the first word in the Russian word combination does not fully reflect the meaning of the English word *sustainable*). However, it is not a matter of translation, but a matter of how we agree to understand the term, i.e. it is a matter of definition again. Translations of the word *sustainable* into some other languages are not that good either: the literal retranslation of the French *développement durable* means *durable development*, closer to the main meaning of the word *long-term*; the German *nachhaltige Entwicklung* means steady, stable development, etc. With the exception of the Spanish and Italian languages that have practically the same words as the English *sustainable* (Spanish—*sostenible*, Italian—*sostenibile*, but that word disappeared from a number of Roman languages, for example, from French and Romanian), no translation can be considered adequate, no translation points to such a nuance of meaning as *continuously maintained* which, though not quite ostensibly, is present in the original and which critics of the Russian translation insist upon. The Russian version should be regarded as one of the best. The word combination *continuously maintained long-term development* reveals the meaning of the notion better, it should be used to explain the term, but the term itself should be as brief as possible.

Some critics claim that the words *sustainable* and *development* contradict each other, that development cannot be sustainable in principle and that “something should be given up—either development or

sustainability.”<sup>4</sup> However, from a philosophical viewpoint development is the subcase of a movement where the complexity and system organization level increase. From another viewpoint, also philosophical, movement is a subcase of development. For our purposes, it is not necessary to resolve that philosophical argument: it is important to note that the *development* and *movement* notions are very close in meaning and that *stability of movement* is one of the key notions in mathematics; hence, there is nothing reprehensible about development sustainability (at least from the viewpoint of mathematics known as the strictest science).

Movement and development are usually identified as changes and sustainability as invariability, i.e. retaining a certain quality, relation or limit as permanent (invariable) under all changes from a specific, necessarily fixed class of possible changes: complete chaos is not a subject for scientific research. (Strictly speaking, sustainability means that certain opinions on the system remain true under all its changes belonging to a given multitude.) All known professional opinions on sustainable development are essentially in line with such understanding.

The *sustainable development* notion is being analyzed, first of all, for the benefit of civilization and mankind as a whole (as the fundamental notion). For other smaller-scale systems (civilization “subsystems”) understanding of the notion should be a derivative from the fundamental one. Let us accept that civilization development for a period in the foreseeable future is sustainable if it retains certain invariance, i.e. neither changes nor threatens any quality, object, relation or limit (there are other appropriate words as well). Of course, here one should not be talking about something insignificant, but about the most important elements of the system whose stability is of interest to us. And the most important problem consists of identifying the fundamental fact for the system, which is that civilization must be preserved under any circumstances. Furthermore, the multitude of changes to be considered must be described. The main goal of civilization is survival, and not only for humankind, for civilization, but for any system predetermined *biologically*, i.e. through *life*. As far as the changes under which survival must be invariable, they are those changes that are caused by human action or those foreign effects that can be prevented or at least mitigated by human action. Trendy talk-shows discussions of the end of the world due to universal catastrophes that cannot be prevented by man have nothing to do with either science theory or practice.

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<sup>4</sup> Valyansky S.I., Kalyuzhny D.V. *The Third Way of Civilization or Can Russia save the World?* Moscow: Algorithm, 2002. p. 140.

## **Natural science approach to development sustainability in the environmental context**

After the Brundtland Commission, UN agencies made practically no attempt to theoretically analyze the concept of sustainable development. However, scientific communities, independent of those agencies made many such attempts. The most significant one appears to be the attempt related to the environment biotic regulation theory developed by Russian biophysicist V.G. Gorshkov.<sup>5</sup> Without going into the details of the theory, we will limit ourselves to considering its basic provisions that are directly related to the problems of sustainable development.

Approximately 3.85 billion years ago, it so happened that the Earth featured conditions favorable for the emergence of life. It could happen only under certain abiotic circumstances, first of all with the flow of energy from the sun absorbed by the planet. But with the same flow the Earth could well be a dead planet without an atmosphere (at least oxygen atmosphere) and practically without liquid water (it could be ice like on Mars or vapor like on Venus), etc. The condition of the environment on Earth is not physically stable, it is continuously subjected to various types of influence, both external (from space by changing solar activity, by falling meteorites, etc.) and internal (geological, i.e. volcano eruptions, etc.). However, for the past billions of years basic environmental characteristics on the Earth have not changed much; first of all, this concerns global average surface temperature (it does not deviate a lot from the value of +15°C, though its physically possible values lie between –40°C global average surface temperature on Mars and +460°C on Venus). The emerged biota existed, reproduced and developed, changing the environment at the same time, and those changes had a purpose: to form conditions suitable—moreover, optimal—for life preservation, reproduction and sustainability. And the environment where biota has existed for the past 3.85 billion years was created by the biota that is developing and evolving under the influence of different incentives (both external, i.e. abiotic, and internal) and restructuring the environment in conformity with both external factors and its own internal changes. Naturally, that “environment” is built of “materials” that were available on the planet before the emergence of life and continued their existence in the course of

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<sup>5</sup> Gorshkov V.G. *Physical and Biological Fundamentals of Life Sustainability*. Moscow: VINITI, 1995. – XXVIII.

evolution—solar energy, chemical composition of the Earth's crust, meteorological processes, etc.

Now, is an appropriate moment to specify the very notion of *environment*; that is what we will call the totality of all material world objects that influence and are influenced by the biota. Naturally, as our knowledge expands, the limits of the environment also expand, not in the evident sense that science discovers new objects, processes and phenomena, but exactly in terms of the interaction of new and old objects with the biota. For example, before the space age, near space could not possibly have been referred to as an element of the environment; however, since 1957 it has been increasingly polluted with man-made “space garbage” that represents a danger not only for space vehicles but also for surface objects (and humans who produce that garbage are part of the biota).

Not only did the biota form the environment vital for it; it still continues to control changes in the environment and to regulate such effects to ensure that environment characteristics are kept within the limits that correspond to the requirements necessary for the reproduction of life. Here is one (out of a multitude) example of such regulation. The Earth's atmosphere contains carbon dioxide (the abiotic source of which is volcanic activity, for example). Surface vegetation and ocean phytoplankton absorb carbon dioxide from the atmosphere and, using solar light as an energy source, produce biomass in the process of photosynthesis; simply put, they grow and multiply. The intensity of that process depends on the concentration of carbon dioxide in the air: the higher it is, the quicker the biomass is produced and the more carbon dioxide that is absorbed by producing organisms (plants and phytoplankton) from the atmosphere. If for some reason (for example, intensification of volcanic activity) carbon dioxide concentration increases compared to normal (stable value to which the biota is adapted), absorption of the gas also increases, i.e. the biota effects regulating compensation functions in such a way as to remove the deviation from the norm and the “surplus” will be extracted. If the carbon dioxide content in the air drops below the norm, it suppresses the producing organisms, the biomass grows slower, carbon dioxide drainage from the atmosphere to the biota declines and its concentration starts growing until it returns to normal. In both cases, the disturbance of the environment (abnormal carbon dioxide concentration in the atmosphere) will be corrected and compensated by the biota. A similar pattern is employed by all man-made technical regulators, for example, the so-called “climate machines” that keep indoor temperature within the assigned limits irrespective of how the outdoor air temperature changes. If the temperature falls below a set limit, a thermostat in such a machine

switches on a heater that operates until the temperature returns to the set interval; if it becomes too hot, a thermostat switches on an air conditioner that cools the air to bring the temperature back to the same interval.

Thus, the Earth's environment is a regulated system and the regulator is the biota, a system of living organisms, a system of life that reacts to environmental disturbances, to deviations from the norm in its parameters so as to bring those parameters back to normal values. By that reaction and by its regulating effect, the biota ensures stability of the environment and keeps it in the condition most favorable for life (and for millions of years, in terms of geological time, it has been supporting an evolution synchronized with the biota's own evolution). What are the capabilities of the biota in this respect? Could it compensate for any disturbances in the environment? Of course not, because the capabilities of any regulator are limited and its compensatory effect can bring results (if possible at all) only when such disturbances are within certain limits: for mechanical regulators, these are the limits prescribed by design and described in the manufacturer's specification. Failure to stay within the limits leads to termination of the regulatory action first and to disintegration of the regulator later. Unfortunately, we do not have a manufacturer's specification to regulate Earth's environment with the biota of the planet.

It is exactly this idea of existing limits within which environmental disturbances must stay so that the biota can adequately react to them to support stability of the environment and hence survive that is key to introducing the *sustainable development* notion into the ecological context.

Being a regulated system, the environment can withstand (without danger of destruction or catastrophe) only a certain class of effects, certain "force" and certain "volume"; that limit is called the *carrying capacity of the biosphere* (or environmental as well as economic capacity).<sup>6</sup> Under *biosphere*, we shall understand synergy of the biota and the environment, i.e. the biota together with all material world objects that influence and are influenced by the biota. If the biota is recognized as a regulator of the environment and of the entire biosphere, it is also necessary to agree that there exists an objective limit of a possible disturbing effect on the regulated system (environment). In a lower-than-the-limit situation the regulator works, in a higher-than-the-limit situation the regulator stops working. In the former case, the biosphere is reproduced, in the latter case destroyed.

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<sup>6</sup> Danilov-Daniliyan V.I., Losev K.S. Economic Challenge and Sustainable Development. Moscow: Progress-Tradition, 2000; Environmental Encyclopedia. In six volumes. Moscow: Encyclopedia, 2008–2013.

In a certain sense, destruction of the environment is a theoretical hypothesis; it has never been either observed in a “natural scale” and sufficiently full volume or, apparently, has never happened (meaning in the Earth’s biosphere). So, such a process is extremely unclear and cannot be forecast with sufficient certainty. The signs of the global environmental crisis that are being recorded today (biodiversity deterioration, growth of greenhouse gas concentrations in the atmosphere, chemical pollution of soils in vast territories, deforestation, desertification, etc.) are of great concern, but they are insufficient to build more or less veritable scenarios of the further development of the environmental crisis. That process should evolve approximately along the following lines: overrunning acceptable limits of the effect on the biosphere first brings the latter into a crisis, where individual ecosystems start degrading, the biota’s regulatory capabilities decline, and its regeneration capacity shrinks (all those processes are primarily related to biodiversity shrinkage). A crisis phase cannot be sustainable: if there is a reaction sufficient to preserve the system, that is if disturbing effects return to normal before irreversible changes begin, the system “self-regenerates,” albeit with certain loss (a new balance in some characteristics may be somewhat inferior to the previous one); but if degradation continues, the crisis phase evolves into a catastrophe where irreversible changes start and avalanche. According to assessments by V.I. Gorshkov and other environmental experts who analyzed the problem from different methodological positions, after the start of irreversible changes in the biosphere the latter’s destruction will take only 10,000 years of historical time, not even geological or astronomical.

Human beings are the main source of disturbance for the biosphere. By the beginning of the twenty-first century, the allowable level of biosphere disturbance had been exceeded approximately tenfold, although assessments vary depending on which indicators were taken as the basis for calculations (a critical point was passed at the turn of the twentieth century). However, the very fact of a massive overrun of anthropogenic biosphere effect limits has never been challenged by any experts on global environment. So, without any doubt, the biosphere is in a crisis phase and we are under threat of a catastrophe as the crisis evolves into a catastrophe.

The above considerations demonstrate that sustainable development is the development where anthropogenic biosphere effect limits are not overrun. That definition is clear scientifically, but it captures only one aspect of the problems—the aspect of ecology directly related to environment. That is not enough, because unregulated demographic processes, unregulated economic growth, crazy overconsumption in