

New Approaches to Classification of Atmosphere Air as a Natural and Environmental Resource

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Abstract— According to the modern understanding the natural resources (NR) are the part of habitat used to support life [5]. In order to develop general methods of their rational use it is reasonable to develop their classification into classes and kinds. Atmosphere air (AA) one of vitally important component of the natural environment. AA as a natural object plays an important role in development of the wildlife and abiocoen, as well as that of society.

Keywords—atmosphere air, resources, functions, energy, nature protection, raw material, landscape forming, wind energy, solar energy, extraction of noble gases, extraction of fresh water

I. INTRODUCTION

According to the modern understanding the natural resources (NR) are the part of habitat used to support life [1]. In order to develop general methods of their rational use it is reasonable to develop their classification into classes and kinds. Atmosphere air (AA) one of vitally important component of the natural environment. AA as a natural object plays an important role in development of the wildlife and abiocoen, as well as that of society.

II. PROPERTIES, FUNCTIONS, AND PRINCIPLES OF USING ATMOSPHERE AIR AS A NATURAL AND ENVIRONMENTAL RESOURCE

AA holds a special niche among natural resources which are meant as set of elements of habitat used to support life on the Earth [2-4]. Unlike other natural resources (NR) AA has a number of specific distinguishing traits. This has to do with such specific properties as presence of multiple components, composition of many objects, and multifunctionality.

AA is a consumption product (along with potable water, for instance), source of energy, a raw material for obtaining some kinds of products. Besides, AA air provides normal habitat for humans as socio-biological being, i.e. is an environmental resource. Because of its movability is not a property of separate states that creates special mode of its use. All the listed peculiarities make it difficult to determine place of AA in the existing classifications of the NR. Thus, in an original classification by N.F.Reimers which takes genetic approach by sources and location as a basis AA is present in several classification units at the same time: energy resources, atmosphere gas resources, climatic resources etc. [5].

By the possibility of self-restoration through natural cycles resources normally are considered renewable and non-renewable. As for capability of replacement of some resources with other ones, they are divided into replaceable and irreplaceable. N₂, CO₂, water vapour can be related to renewable ones because for these gas component the natural cycles are practically closed, at least for short periods of time. More over, there is a trend for increase of CO₂ content since early 20th century approximately by 18%. The O₂ and O₃ cases are slightly different. At present, consumption of free oxygen connected with its oxidizing reaction while burning fossil fuel exceeds its inflow by approximately 10 times. According to Academician F.Davitaya estimation, at present speed of oxygen consumption for all the kinds of fuel the amount of consumed oxygen will reach a critical value that is 2/3 of present reserves [6]. Even if this sad forecast does not come true, change of gas composition of the atmosphere will entail change of energy component of natural system and take it out of balance. Also, there is trend for ozone content to reduce.

The wind energy is a renewable resource capable of being utilized in the world economy [1, 3]. Apart from that, based on entropic understanding of the world it is necessary to reduce consumption of non-renewable resources as well as to implement the course for energy efficient economy based on renewable resources (solar energy, with energy etc.).

A special place belongs to the atmosphere moisture as resource. According to the data available, there are 12.9 thousands km³ or 0.04% of total available water in atmosphere [7]. And atmosphere moisture renews in average every 8 days. In the Central Asia, vapour form moisture content in mountain foot hill area is about 1-2 kg/m² in one km of atmosphere. In the mountains it is by 1.5 times less. Despite this insignificant by absolute magnitude reserves of atmosphere moisture its importance for the arid zones is exceptional because some times it is the only water resource to support existence of desert ecosystems [7].

From the point of view of economic restoration resources may be replaceable and not replaceable. In this respect atmosphere oxygen and nitrogen participate as raw material in obtaining of some kinds of products (fertilizers, metallurgy etc.). Their replaceability and not replaceability will be conditioned by respective technology of production. The group of noble gases (Ar, He etc) belongs to not replaceable ones.

The next very important peculiarity of AA as a natural resource is, as it has been said, that it is multifunctional by

which we understand diversity of its realisation in the interaction with megasystems “nature-society”. The classification of the atmosphere air will be given below.

Finally, the third peculiarity of the AA is that its content is capable of changing. In this respect it belongs to a special kind of natural resources condition of which is in close connection with anthropogenesis. Development of industrial production and transportation led to emergence of a number of problems connected with pollution of the air basin. In particular, utilization of traditional resources as well as introduction of substances that are not in biosphere has pushed qualitatively new pollution of the atmosphere including that with synthetic, toxic, and hard to decay elements, aerosols of heavy and rare metals etc. Thus on the one hand a group of substance has emerged that depreciate other ones (anti-resources), on the other hand some other of the gas exhausts may be involved into production process.

A group of gases termed as small gas components of atmosphere and playing significant role in creation of green house effect should be specially pointed at [6]. These are first of all chlorofluorocarbons, methane, and nitrogen monoxide. The role of anthropogenic aerosols in the climate change is not clear enough yet.

Based on the above peculiarities of the AA we provide classification of its functions. The classification of AA functions built on the basis of systemic model of its use contains two main types: non-raw material and raw material one (Fig.1) Non-raw material function fall into functions connected both with megasystem “nature” and megasystem “society”. Function basically used for support of the environment level form landscape shaping class. The functions connected to megasystem “society” form so called social class. The functions one way or another connected to the both megasystems form bioecological class.

The landscape shaping role of the AA consists of that climate being an element of landscape at the same time shapes that landscape. We refer to the L.S.Berg’s landscape botanical classification of climates [7].

Bioecological functions of AA consist of, first, formation of photosynthetic active radiation (PAR), i.e. spectrum of the solar rays in the range 380 to 710 μm producing the most impact on vegetation. Second, certain climatic conditions emerge in the atmosphere that impact human, animal, and plant vital processes and functions. These are level of radiation, moist content of air, thermal load etc. Besides, humans are meteorolabial, i.e. they react to any changes of weather (temperature, wind, pressure etc.) one way or another [5]. Finally, in bioprotection aspect, the role of O_3 is extremely important.

The AA social functions are transmitted via quality of AA, i.e. degree of its parameters’ compliance with permanent human needs (consumption product), as well as human rest and health by means of supporting proper quality of air (temperature, humidity, ionization etc.). In this case, AA appears as a part of other respective natural resources (forest, water) and cultural resources. These functions make sanitary hygienic and recreation sub-classes. Besides, the AA produces

favourable combination of natural factors positively impacting on humans through senses (colour of sky and dawn, optical phenomena, transparency, view of clouds etc.).

The raw material functions of AA closely connected with megasystem “society” and aimed at creation of conditions for economic activities of humans, i.e. they are means of labour, sources of energy and raw materials.

Let us to consider structure of rational use of AA as NR. Under rational use “the system of activities designed for securing saving exploitation of the natural resources and conditions and the most objective mood of their reproduction taking into account prospective interests of developing economy and preservation of human health” [1, 2] is meant. In general, nature use consists of utilization of natural spheres for functioning of social spheres, i.e. it acts as channel of communication between the two megasystems (nature-society). Thus, nature management envisages not only natural resources development and transformation for satisfying material and spiritual needs of the society but protection of natural conditions of habitat. It needs to taken into account that the structural peculiarity of nature management takes various forms depending on properties of the natural resource.

With regard of atmosphere air, taking into account its peculiarities, functional structure of its rational use looks as the following hierarchical form. The resource itself, i. e. AA is meant as the zero level. The next level is supposed management of rational use that is systematic realization of targeted impact of the society on AA taking into account its functional potential and securing its protection as a natural resource. The management is realized through complex of legislative and directive acts, instructions etc. The next three levels are connected with use of the leading AA functions: social, bioecological, raw material, and landscape shaping.

As the atmosphere with regard to the nature is a system of lower order (along with biosphere, hydrosphere, pedosphere, and lithosphere), then at the second level those functions that are not connected to the society must emerge. These are protective and productive functions, as well as functions securing vital activities of organisms. The third level is made up of those function of AA that condition some kind of economic, biological, and social activities of humans. And, it is most important, that human activities do not pollute the atmosphere that condition allows maintain certain quality of life. The quality of life can be characterized by a number of criteria that include, in particular, bioclimatic indices, parameters of the air cleanness, etc.

Finally, the fourth level is composed of those kinds of human activities and services that directly are connected with utilization of AA as raw material. These, first of all, processes connected with burning of various kinds of fuel in vehicles as well as thermal power plants. Just at this level the negative impact on atmosphere by means of its pollution takes places.

Management of rational use of AA consists of development of a complex of air protection measures aimed at elimination of such impact at the higher level of use. And set of air protection measures that are part of nature protection problems must be

large scale spanning from global one to regional and even micro scale, i. e. on the level of isolated source.

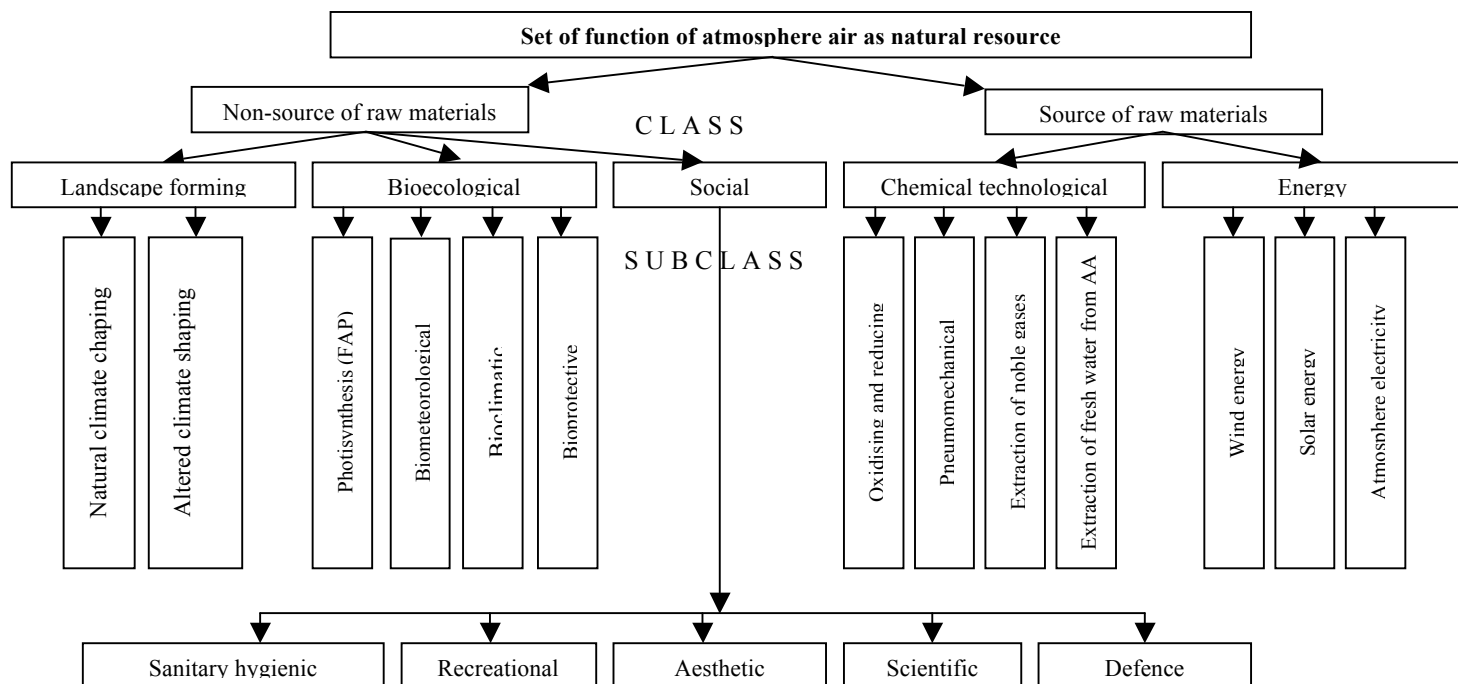


Figure. Classification of the Atmosphere Air.

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