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BIODIVERSITY AND BIOSPHERE EVOLUTION

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Abstract. The evolution of the biosphere, from a thermodynamic point of view, passed through four stages, each of them coinciding with an ecological revolution. After the appearance of life, the first ecological revolution was the oxygenic photosynthesis, owed to the cyanobacteria, from about 3 billion years ago. The accumulation of energy in biomass led to a decisive tilt away from the thermodynamic equilibrium. The second ecological revolution – the appearance of monocellular eukaryotes, enhanced this tilt. The third ecological revolution – the appearance (explosion – Gould, 1991) of Metazoans needed a higher oxygen concentration in the atmosphere. The fourth ecological revolution was the appearance of terrestrial vegetation and fauna, especially insects. The fifth revolution – the appearance of mankind. This revolution, through overpopulation and overexploitation of resources, became a negative stage in the biosphere evolution, leading to biodiversity decrement and inversing the natural flow of biosphere evolution – the tilt towards thermodynamic equilibrium becoming more and more perceivable.

Résumé. L'évolution de la biosphère, d'un point de vue thermodynamique, adopté par quatre étapes, chacune coïncidant avec une révolution écologique. Après l'apparition de la vie, la première révolution écologique a été la photosynthèse oxygénique, due aux cyanobactéries, de l'ordre de 3 milliards d'années. L'accumulation de l'énergie de la biomasse conduit à une inclinaison décisive loin de l'équilibre thermodynamique. La deuxième révolution écologique - l'apparition des eucaryotes monocellulaires, le renforcement de cette inclinaison. La troisième révolution écologique - l'apparition (explosion - Gould, 1991) de métazoaires a fait nécéssaire une plus grande concentration d'oxygène dans l'atmosphère. La quatrième révolution écologique a été l'apparition de la végétation terrestre et de la faune, en particulier les insectes. La cinquième révolution - l'apparition de l'humanité. Cette révolution, par le biais de la surpopulation et de la surexploitation des ressources, est devenue négative en phase d'évolution de la biosphère, ce qui conduit à la diminution de la biodiversité inversant le flux de l'évolution de biosphère - l'inclinaison vers l'équilibre thermodynamique devient de plus en plus perceptible.

Key words: thermodynamics, ecological revolution, climate change, biosphere support capacity.

The biosphere evolution is a complex and long-lasting process, during which, the biodiversity (we'll address especially the species diversity) has a crucial role, due to its energetic factor.

Thermodynamics shows that all real systems are in one of three statuses: 1. Thermodynamic equilibrium status. In this state the systems are inert; 2. The status of semi-inert systems, with a tendency towards the first one; 3. The status of all biologic systems. The biologic systems do not tilt towards thermodynamic equilibrium, but away from it. This distance is conditioned by a constant increase of energy intakes into the system (Laszlo, 1987).

Taking into account that on the biologic time scale the incident solar energy is constant, the increase of energetic intakes can be achieved two ways: one way by increasing the number of individuals and the second way by increasing the number of species, and thus increasing biodiversity. Evidently, both processes lead to a biomass increment, and thus to an accumulation of energy into the system.

Even now it is unknown how life originated. What is known is that it happed approximately 3.8 billion years ago, by bacteria.

The primitive atmosphere comprised preponderantly CO_2, lacking or almost lacking oxygen. The bacteria were dominant in the primitive biodiversity structure for more than two billion years. Several causes determined this period. The fist one is the bacteria structure: the rigid cover didn't allow either their growth or the particulate food ingestion, but only external digestion. The second one is represented by the low efficiency of the anaerobe metabolism (19 times lower than the aerobe one). These traits slowed down both the evolution, and the biomass (energy) accumulation.

After the origin of life, the first qualitative change, which may be considered as *the first ecological revolution*, was the appearance of *oxygenic photosynthesis*. It worth mentioning, that it was preceded by the anoxygenic photosynthesis, where the H source (for CO_2 reduction) was H_2S, the resulted oxygen being used in the internal metabolic processes of the bacteria, and not released in the environment (water, atmosphere).

The oxygenic photosynthesis appeared with the cyanobacteria. In this process, the H is obtained by water photolysis, and the oxygen is released in the environment. This process appeared about 3 billion years ago, fact proven by stromatolithes – geological structures formed by cyanobacteria aggregations; they appear even today in hot climate areas. The oxygen in water and atmosphere, as well as the biomass accumulated very slowly, forbidding the apparition and development of more complex organisms.

The second ecological revolution is represented by the *unicellular eukaryotes appearance*, as a result of the symbiosis between the archaebacteria (that are lacking the rigid cover, being thus able to feed through phagocitosys) with cyanobacteria. This event took place about 1.5 billion years ago. Monocellular organisms appear, with complete cell, with new cellular organelles missing to the prokaryotes, and who, at different species show the sexual process as well. The pluriphyletic origin of the eukaryotes (disputed by certain authors, for example Michold & Nedelcu, 2004) due to the diversity of the symbiotic combinations, of the horizontal genetic transfer (Woese, 1998; Doolitttle, 1999; Dawson & Race, 2002; Hartman & Fedorov, 2002) contributed to the significant growth of the species biodiversity, to the growth of the efficiency of the metabolism turned into an aerobe one, to the acceleration of the biomass accumulation and to the process to avoid the thermodynamic equilibrium.

These transformations had important ecological consequences, among which we would like to remind the structuring of the first trophic cycles (due to the phagotrophy of many unicellular eukaryotes) and the acceleration of matter recycling in ecosystems.

500 million years ago, at the end of Precambrian (therefore 3 billion years after the beginning of life) takes place *the third ecological revolution*, through the "explosion" (Gould, 1991) of the metazoans, multicellular animals from all the present phyla (including the Chordates) and many extinct phyla.

Of course, it's natural to ask why the Metazoans appeared so late. The main cause was that the animals with a more complex structure, much bigger (comparative to the unicellular organisms), with a much bigger energy consume need an atmosphere with more oxygen. This "explosion" of the Metazoans took place at the end of the Precambrian when the oxygen concentration in water and atmosphere was close to the one found nowadays (Fenchel & Finlay, 1994; Berner, Van dem Bröoks & Ward, 2007).

The birth and fast evolution of the Metazoans represented a huge step for the growth of the structural and functional complexity of the organisms, for the fast rise of the biodiversity and of the quantity of energy stored in much bigger biomass.

The fourth ecological revolution took place in Silurian (Valentine, 1977; Wilson, 2002), approximately 400 million years ago and consisted in the birth and fast differentiation of the terrestrial vegetation that led to the penetration of new and rich mineral sources of the land. The development of the vegetation was shortly followed by the "explosion" of the insects and other groups of animals, phytophagous and predacious as well. The fast growth of the structural and functional complexity, thus the growth of the biodiversity led to the significant increase of energy intakes in the biosphere system, to the increase of matter recycling pace, and, very important, to the atmospheric CO_2 concentration decrement, because of photosynthesis spreading and enhancement.

The growth of the plants diversity (primary producer) led to stability improvement (resilience) and to the increase of the ecosystems productivity, therefore to the increase of the biomass and energy within the system.

As for the role of the biodiversity in the resilience and productivity of the ecosystems there takes place an important dispute on which we will not stop. Certain biologists deny its role, supported by the recognized scientists in ecology, such as Elton, Odum and others, and by certain contemporary ecologists, primary making mention of Tilman, who alongside of his collaborators (Tilman & Downing, 1994) demonstrated this role experimentally, later confirmed by many other researchers.

Odum (1993) offered the first conclusive explanation on the role of the biodiversity in resilience improvement. The biodiversity development led to the improvement of the functionally redundancy of the primary producers: when a certain species production diminishes or vanishes for different reasons, it is alternately counter-balanced by the ecosystem's other species primary production, this way insuring the stability of the ecosystem (Yachi & Loreau, 1999).

In addition to this explanation I have to add another important aspect. All the primary producers fill the same function in the given ecosystem: produce the food used by all the consumers. However, from a structurally point of view there is no redundancy: the food produced is specific to each plant species. This diversity of food stimulates the development of the consumers' diversity from all the trophic levels, and the increase of the energy incomes inside the system. The global effect is the moving off from the thermodynamic equilibrium and the progressive evolution of the biosphere.

The fifth and the last ecological revolution in the biosphere evolution took place simultaneously with the appearance of man. Unfortunately we can only consider it as a negative evolution, because it leads to the most fastest and intense extinction of species, consequently to the diminishing of the biodiversity, the decrease of the energy intakes into the biosphere and therefore to the inversion in the process of avoidance of the thermodynamic equilibrium. There could be noticed a more acute tendency towards this equilibrium.

We will briefly stop upon the main causes for this process.

1. The *chaotic and uncontrolled growth* of the human population, which nowadays exceeds by 20% the support capacity of the biosphere (Wackernegel et al., 2002) daily growing with approximately 200000

people (Wilson, 2002). Sooner the population will number 7 billion. Already over 850 million people are underfed (Money et al., 2005).

2. *The drinking water problem*. On a global level 97% from the planet's water is the salty water from seas and oceans. Approximately 2% is stuck inside polar and mountain ice. There is only 1% left for drinking, irrigating, industrial reasons and other needs. It is estimated that nowadays 2.5 billion people drink not drinkable water. More than 5 million people annually die from diseases as cholera, dysentery and others, derived from the non drinkable (Montaigne, 2002). For irrigations and city needs even the subterranean water is being pumped. (We will refer to the problems concerning the drinking water in the global warming paragraph).
3. *The natural resources overexploitation.*

Deforestation.

Globally the forest held and still holds a central importance in the evolution of the entire biosphere biodiversity. The forest is the main source for a big number of important products for the human life and economy – wood, fruits, mushrooms, game, medicinal plants, and drinking water and in the same time the ideal place for recreation, and for maintaining a healthy spirit. To all this aspects there has to be taken into account the essential role of the forest in the biosphere global ecology, through slowing down the global warming due to the CO_2 consume (the main gas with a greenhouse effect) in the photosynthesis process. Simultaneously the forest shows its influence upon the rain regime, local and regional as well. Besides, we have to emphasize that among all the terrestrial ecosystems the forest represents the life environment for the biggest number of species of all kingdoms, which irreversible vanish once the forest are cut down. Besides, the forest's soil behaves as a sponge absorbing big quantities of water, which moderates streaming waters and floods.

Recent studies show that the tropical deforestation releases into the atmosphere approximately 1.5 billion carbon metrical tones per year, and this since 1990. This quantity represents around 20% of anthropogenous gases. There is estimated that, unless the tropical deforestations stop, until the year 2100 there will be released 87-130 carbon metrical tones, thus more than the fossil combustibles use in ten years. (Gullison et al., 2007).

The forest destruction by man started very possible since the Paleolithic. As Wilson said (2002) man burned down the forest when he wasn't able to cut down the trees. An antic civilizations historian, Saggs (1989), advances that the oldest technological progress since prehistory that didn't leave any trace is the usage (not as well the production) of wood. Noticed in Africa, South from the Rudolf lake, the use of fire dates for more than a million years (Collins, ed., 2003) and continues as well nowadays extremely acute and severe (Whitlock, 2004). Besides its usage as an instrument to stir up game (Odum, 1993; Budyko, 1984) fire was an instrument to cook, to craft wooden tools and to protect against predator as well. For example the Neanderthals (middle Paleolithic) hunted mammoths, for meat, while the big bones where used as combustible in those places where no wood could be found (North) and for building up shelter (Alper, 2003; Collins, ed., 2003; Starr, 1991).

Fire played a main role in the evolution of the relations man-nature. We would like to stop only at the primitive man, from the early Paleolithic, 1500000 years before. The question still remains, whether those men knew how to start fire or only knew how to use it, produced by natural causes (twilight, burning lava). The difference between these is very important: if they knew how to start fire, it should become an important instrument, on one hand a destructive one, against de forests, being used to stir up game, and on the other game an important instrument for human survival through hunting and warming, cooking and defense against predators.

The archeological atlas, edited by Collins (2003) considers that the usage of fire in Africa is older than 1000000 years without any proof of starting it.

I think that the intelligence of the primitive man is underestimated.

Goodall stunned the world by proving that the chimps are creating and using tools for capturing termites (Peterson, 2006). But this phenomenon is rather well spread in the animal world. The ant *Allomerus decemarticulatus* builds from plant fibers – which it cuts, then binds together with the mycelia of the fungus cultivated in its anthill – a kind of sponge, in which galleries various insects are captured, thus adding nitrogen to its diet (Dejean et al., 2005). Other ants are building their nests on leaves, by sewing together the leaf margins. For this, they are using their own larvae, which secrete a thread used to bind the leaf that becomes their shelter. Also, the ants and termites have invented agriculture millions of years before mankind.

There are several known bird species that are using and processing thorns for extracting the insect larvae from their galleries.

The Inferior Paleolithic men, from over a million years ago, who made the first stone tools through knapping, by hitting stone on stone. If this operation was done in the savanna during the dry period, or in a dry forest with desiccated grass and leaves, is more than sure that the generated sparks could set the vegetation on fire. This became the unintentional discovery of *producing* fire. This way appeared the primitive tinder box, the first method of obtaining fire when needed. Maybe the tinder box found with the Iceman (Ötzi), who laid frozen in the Alps for 5300 years, can tell us something in this respect (Dickson, Oeggel & Handley, 2003; Hall, 2007).

Around the same time, at the beginning of the Neolithic era, the agriculture appears – a new and strong motive for burning the forests and clearing the land for first cereals cultivation (wheat and barley), as well as for extending the pastures needed by the domesticated animals (goats, sheep, cows, pigs) (Saggs, 1989). The oldest proof of agriculture practice (plant cultivation and animal breeding) comes from Catalhöyük, situated in Anatolia, and having an estimated age of 8000-11500 years (Hodder, 2006). It was in practice then, as it was today, the so-called itinerant agriculture: a surface of forest was burnt, and then seeded. The tropical forest soil being poor in resources, the crops were worth the labor for 2-3 years at best, after which the parcel was abandoned, and another surface of forest cleared. Moreover, there is even today in practice the burning of grass cover. In Africa, the savannas are set on fire during the dry period. But this happens not only in Africa. For example, in Romania, in many areas, the stubbles are set on fire, and in the Danube Delta it is an old fisherman tradition to burn the reeds in autumn and late until spring. In an empiric way, both the cultivators and the fishermen know the value of this tradition – enriching the soil and water with minerals, and in the delta, also, the land clearing for a better growth of young reeds, that have various domestic uses.

In these areas, many plants have adapted to fire. For example, the reed in the delta begins its growth ever since the winter. The young plants, named “suligă”, measuring 20-30 cm, have a sort of night cap, which burns during the fire and in short time falls off, allowing the plant to grow uninhibited (Botnariuc, 1976).

Deforestation leads to the rapid decrease and even extinction of all forest benefits, also having in turn harmful consequences: fast soil erosion by streaming waters that are carrying the soil into rivers, enhancing their debits, causing extremely destructive floods, as happened in Romania during the last years. “Forests have had a pervasive influence on the evolution of terrestrial life and continue to provide important feedbacks to the physical environment, notably climate.” (Sugden, Smith & Pennisi, 2008).

Nowadays, at the scale of the entire biosphere, the human activities of forest destruction lead directly or not to profound changes of all forest related processes: climate, physical, chemical, biological processes, essential biosphere processes – carbon cycle, water cycle, atmospheric chemical structure (Bonan, 2008)

Deforestation rhythm at the global scale is alarming. It is estimated that every 5-10 years a million km^2 of forest are disappearing (Raven, 1991), that is a surface almost four times larger than Romania. Extremely intensive is the deforestation of tropical areas. We’ll give only two examples, both of them from South America: in Ecuador 2380 km^2/year, and in Brazil 36710 km^2/year (Wilson, 2002). Almost with the same rate are cleared the forests in Africa and South-Eastern Asia. This intense deforestation not only cancels all forest benefits, but leads to many species extinction, causing a rapid biodiversity loss. The estimate of the number of species that annually disappear varies between 27000 (Wilson, 2002) and 30000 (Eldredge, 1998).

There are initiatives, some even put into practice, for reforestation with tree monocultures. Thus, in Borneo, famous for its natural forests, with a high plant and animal diversity, the forests are cut and replaced, at an ever larger scale, by plantations of *Acacia mangium*, a rapidly growing species that is cut down at the age of seven, thus being a very good wood resource (Cyranoski, 2007). The same phenomenon is noticed in Romania – the diverse forests, rich in plant and animal species are replaced by plantations of rapidly-growing poplar, in which no bird can nest.

Moreover, a certain percent of the resinous forests in Bucovina are planted. Characteristic for this type of forest is that all the trees are of the same age. These forests are extremely vulnerable: I’ve seen entire forests of this type thrown down by a storm that left unharmed the nearby natural forests. But these do not summarize all the unfortunate outcomes of deforestation.

Most of the time, deforestation is followed by *overgrazing*, another form of resource overexploitation. If we take into account the fact that, as Odum (1993) noticed, the quantity of food (biomass) consumed by domestic animals (cows, pigs, horses, sheep, goats, poultry) exceeds the human population consumption, if we consider that in many areas some of the domestic animals (i. e. the cattle, and the sheep in some areas of Africa) are neither milked nor slaughter, but rather representing an indicator of social status, overgrazing is detrimental and leads to surpassing the support capacity of pastures, converging to the gradual *desertification* of the area, and expansion of anthropogenic desserts.

Sahara, the largest desert, with a surface of 8600000 km^2 is of anthropogenic origin, as the archeological, paleontological and historical data concur. Costantin (1980), historian, expert in ancient civilizations, ascertains that Egypt, West of the Nile valley was neighbored by “Sahara’s wastelands, inhabited by cattle breeders”. On the other hand, Lhote (1966) sustains that the Tassili frescoes, situated in plain desert, exhibit Egyptian influences. He also mentions Herodot’s affirmation, that during the VI-th century B. C., on Sahara’s surface six different peoples lived. Even the Tassili frescoes show that the animals living today in the savannas lived and were hunted in Sahara. There is also to be mentioned that in the "Atlas of Archaeology" (2003), published by Collins, at p. 57 is said that "The dense scatter of sites in what is now Sahara desert indicates that more favorable conditions for human settlements existed there at certain times during this period" – it refers to the "developed Oldowan or Pre-Acheulian", from about 1.5 million years ago, during the Early Paleolithic, characterized by the knapping of flint tools.

At last, if still needed, we present one last proof of Sahara's situation. In the northern part of the state of Chad, there is the Yoa Lake, today with hypersaline waters. A research team has studied the structure of this lake – sediment structure, geo-chemistry and biology (pollen, spores and other paleontological remains). Their conclusions show that about 6000 years ago, the lake had fresh water and Sahara was not a desert, but covered in vegetation (forests and grasslands) (Kröpelin et al., 2008).

In Asia, about 1000 years ago, the territories of states like Iran, Iraq, Syria, Uzbekistan, Turkmenistan, and Kazakhstan were covered by prosperous forests and pastures, as the historians research suggests. Pravdin (1951), Cooke et al. (1981) are describing the migrations of the nomad Mongol tribes, from Extreme Orient, reunited by Genghis-Han, about 900 years ago, that advanced into the West and found pastures for their cattle and horses. Let's see the description given by Parrot (1979) to a fragment of this area, between Euphrates and Tigris "this land dry today, was of heavenly fertility at that time, the cradle of the formidable kingdoms…" (p. 46). Now, the territory of these states is a semi-desert, primarily as a direct consequence of overgrazing.

The negative effects of resource overexploitation can also be seen *in oceans*. It is estimated that about 70% of fish species, the most important economically, are almost exhausted, as are some of the whale species. "The dramatic decline of fishing in the Northern Atlantic, and also in the world, is owed to overfishing, but also to climate change (Schiermeier, 2004). About 20-25 years ago, even competent biologists considered that the oceanic resources are limitless. The present situation shows a different reality. Susan Schiefelbein, the collaborator of Jacques Y. Cousteau, after his death, updated some of his data concerning global oceanic resources overexploitation.

1. "About 20 percent of the ocean's fisheries have collapsed."

2. About 90% of carnivorous fish in the ocean, including the cod (*Gadus morrhua*) and the tuna (*Thunnus thunnus*) are exhausted.

3. It is estimated that the survival of about one billion people depends on fish. At the same time, for obtaining one pound (450 gr.) of carnivorous fish in fisheries, five pounds of (*Scromber scromber*) and anchovies (*Engraulis encrasicholus*) are used, species that represent the food of poor population (Cousteau & Schiefelbein, 2007).

This situation is not a novelty, as the fishing rate has surpassed the ocean's support capacity. This capacity is determined in its turn by the phytoplanktonic activity, which contributes about 50% to the primary production of the biosphere (Behrenfeld et al., 2006). The phytoplanktonic primary production depends upon light and nutrients (N, P, Fe), and their presence depends on water circulation, including vertical currents and water stratification. During the last period, a strong and rapid decrease of the net primary production of phytoplankton was recorded, from 1930 Terra-grams C (TgC/year) about 10 years ago, to 190 TgC/year today.

The main cause consists in alterations of water stratification due to surface water temperature, fact that influences the nutrients availability.

Another consequence of human activities is the *pollution of all life environments*. This activity has led to changes in the chemical composition of the atmosphere, of the soil, of the running and ground waters and even of the oceans, and to what is probably its worse effect – climate change.

We'll discuss briefly the ground waters, one of the main drinking water sources, and the main basis for some subterraneous ecosystems existence, i.e. the one at Movile in Dobrogea - Romania (Sârbu et al., 1996), considered as autotrophic, their fauna having as primary producers the anaerobe bacteria in underground waters.

By analyzing this rather well spread phenomenon, the zoologist Por (2007) identified and characterized it as a new biome, named *Ophel*, that incorporates also the abyssal ecosystems formed around the sulfurous thermal springs from the bottom of the oceans. This vision opens new research perspectives.

Atmosphere pollution and its effects – global warming – occur mainly due to greenhouse gases emission. Prinn (2004) numbers 26 greenhouse gases and precursors. It is considered that the main role in global warming is played by CO_2 and CH_4.

The CO_2 concentration has grown rapidly, especially during the last decades, alongside the spectacular industrial development and the ever intense use of fossil fuels. In 1800 the atmospheric CO_2 represented 280 parts/million, and today it represents 380 p/m. To seize the magnitude of this process, it is enough to say, that only from electricity production, 9.9 billion metrical tons of CO_2 are released into the atmosphere (Petit, 2006). To the global warming phenomenon, an essential part is also played by CH_4 which stores the heat 20 times more efficient than CO_2, but has a shorter "life". The annual emission of CH_4 is estimated to about 550 million tones.

The concentration of methane in the atmosphere has tripled during the industrial era. The known sources of methane in the atmosphere are the anoxic media, like swamps, rice pads, and ruminant mammal's stomach. But these sources do not explain the present atmospheric concentration.

Recently it is mentioned that CH_4 is formed "in situ", in terrestrial plants, in oxygen presence. The process that produces methane is still unknown but they consider it is emitted by intact plants and detached leaves. They estimate that following this in the atmosphere there are 62-236 Tg/year, emitted by living plants and 1,7 Tg/year emitted by litter.

One of the major consequences of the global warming is the melting of ice blocks. Measurements from satellite show the diminishing of polar ice blocks at the Arctic as well as in Antarctica. A foreseen consequence is the rise of oceans level, which if continues could lead to the flood of huge areas with many urban villages and agricultural lands. Another consequence – the melting of the mountain ice blocks. The aftermath of this phenomenon are incalculable, taking into account that a great number of running waters, essential source of fresh water, will either disappear or their flow will diminish, followed by all their consequences. Finally must be mentioned the consequences of the permafrost melting, already taking place in Northern America, Europe and Asia (Appenzeller, 2007).

The consequences to all these processes are difficult to evaluate, due to their big number and complexity. Besides the economic processes, concerning navigation, agriculture, irrigations, electricity, drinking water, certain ecological processes are in progress: the disorganization of the migrations for a great number of species (especially birds and mammals), the growth of extinction danger for species like the white bear (polar), or penguin species. Changes in the phenology of plants disorganize life and biological cycles, as well as the existence of many animal species, and the normal functioning of ecosystems (Edwards & Richardson, 2004).

Even now global warming already affects the distribution and the abundance of a big number of plants and animal species. It is estimated that until 2050 15-37% species will become extinct unless there will not be taken measures to reduce the greenhouse gases emission (Pounds & Pushendorf, 2004; Thomas & al. 2004).

Global warming has changed the atmosphere-ocean interaction, as seen along other facts through changes in thermo-haline circulation, depending on the water's temperature and salinity, and on the functionality of vertical currents (upwelling), which bring on the surface useful nutrients for the phytoplankton (N, P, Fe). In fact the phytoplankton assures the primary production of the ocean, therefore the trophic base of all the consumers. Changes of these trophic base show severe consequences over the entire biosphere. Recent studies indicate that the oceanic phytoplankton contributes with 50% to biosphere's entire primary production. It is estimated that daily over 100 millions C tones (as CO_2) are fixed by the phytoplankton, approximately the same mass being transferred to oceanic ecosystems – whether deep ecosystems (as following), whether through the direct consume of the surface phytoplankton.

The primary production of the phytoplankton depends on light and nutrients. The nutrients concentration, at its turn depends on the water stratification, on the horizontal and vertical currents (Doney, 2006; Behrenfeld et al., 2006).

In the North Atlantic Ocean the Gulfstream is present, a surface current which brings warm water from the Equator to North-East, warming the Western and North-Western European climate. During its Northern movement the tropical origins water cools down gradually, becoming denser. It's important to notice that in the polar region, due to the global warming, the ice melting leads to the decrease of the water salinity. That's why, when the Southern stream arrives in the North its more dense water gradually sinks. Obviously this water brings the nutrients and the phytoplankton, which, partially will be consumed by phytoplanktonophagous, partially sinking carrying with itself nutrients, food and O_2, resources used by the profound fauna (Quadfasel, 2005; Schirmeier, 2006; Schmittner, 2005).

In these conditions it's obvious that if the global warming should go on, the stream diving will move step by step towards South, endangering the life conditions of the Northern benthic fauna.

The increase of the CO_2 concentration in the atmosphere leads as well to this gas's concentration growth in the oceanic water. A part of the CO_2 dissolved in the oceanic water give birth to the carbonic acid, which leads to the reduction of the pH, therefore to the acidification of the oceanic waters. It's true that in 1800 the oceanic pH was 8.16, and today is 8.05, being estimated that until the end of the century it will diminish to 7.9. At a more severe lowering the effect should be catastrophic, as well for plants as for animals (Orr et al., 2005; Ruttiman, 2006).

The oceanic water's chemical pollution and warming is also proven by the corals extinction, at a more bigger scale, which form the coral reefs – centers of the oceanic fauna biodiversity, only to be compared to the equatorial forest fauna. Coralloid reefs are the vital source for biodiversity and oceanic productivity.

Nowadays these ecosystems are endangered, being very sensitive to water warming and pH diminishing. Mortality interferes whether the oceanic water temperature exceeds 29°C, or when the water turns acid, due to pH diminishing. Acidity deteriorates the limy coralloid skeleton, composed from aragonite, more soluble than calcite bringing on the death to symbiotic algae. It's considered that 25% of all the coralloid reefs are definitely degraded and whether the global warming should continue than 60% coralloid reefs will be exterminated. Certain scientists consider some corals heterotrophic being able to survive (Grottoli et al., 2006), as well as some variants of the symbiotic alga (*Symbiodinium*) are heat resistant, allowing coral survival. (Baker et al., 2004).

If next to these activities which lead to habitats and ecosystems destruction, to the accelerate extinction of species we add devastating wars which affected human kind since its origins, and which especially during modern times consumes huge material means and energy, without concern to any destructive consequence, then we should realize that human being became a first term agent in the deterioration of his relationship with nature and in its disorganization.

From the energetic point of view we started with, the main and most severe consequence is the fast decrease of biodiversity which leads to the diminish of plants CO_2 consume, therefore to the more faster increase of its concentration in the atmosphere and to the accentuation of global warming, and on the other hand leading, for the moment only locally, to the more acute tendency for a thermodynamic equilibrium.

This is the main effect of the activities describing human race, proven to be an aberrant species, whose evolution is no more a biological process but only a social and technological one.

There is no doubt: the human being is the most intelligent species but not the most wise.

BIODIVERSITATEA ŞI EVOLUŢIA BIOSFEREI

REZUMAT

Evoluţia biosferei examinată din punct de vedere termodinamic a parcurs patru etape, fiecare coincide cu o revoluţie ecologică. După apariţia vieţii, prima revoluţie ecologică – fotosinteza oxigenică – datorată cianobacteriilor, de acum aproximativ 3 miliarde de ani. Acumularea energiei în biomasă ducea la o îndepărtare decisivă de la echilibrul termodinamic. A doua revoluţie ecologică – apariţia eucariotelor monocelulare a accelerat procesul îndepărtării. A treia revoluţie ecologică – apariţia („explozia" - Gould, 1991) metazoarelor a necesitat o concentraţie mai mare de O_2 în atmosferă. A patra revoluţie ecologică – apariţia vegetaţiei şi faunei terestre, în primul rând insecte. A cincea revoluţie – apariţia omului. Această revoluţie, prin suprapopulare şi supraexploatarea resurselor, a devenit o fază negativă în evoluţia biosferei, ducând la scăderea biodiversităţii şi inversarea sensului evoluţiei biosferei – apare tot mai accentuată tendinţa apropierii de echilibrul termodinamic.

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