of species existence. The overwhelming majority of positive substitutions appear in the course of evolutionary tuning (Figure 11.1) shortly after acquisition of a positive macrofragment that initiates speciation, while during the remaining time of the species' existence no directional changes take place in the genome. Thus it makes no sense to speak about the average number of substitutions per year during the whole lifespan of a species.

11.5 CONCLUSIONS

Taking into account the fact that for the majority of the time of their existence all species remain in a state of evolutionary stasis, the problem of tempo and mode of evolution is of but secondary importance to the biotic regulation concept. The biotic regulation concept pertains mostly to the everyday existence of species and their everyday work on stabilisation of the environment.

However, we considered it necessary to briefly discuss in this chapter the major empirical data on evolution. This was done in order to show that all of them find an explanation within the biotic regulation concept. In other words, the existence of evolution neither discredits the biotic regulation concept nor provides evidence for genetic adaptation of species to the changing environment. Moreover, the proposed evolutionary pattern that arises from the central genetic issue of the biotic regulation concept, namely that of genetic stability of species which is necessary for stabilisation of an optimal environment, provides explanation for some evolutionary questions (like that of uniform evolutionary rate in prokaryotes and eukaryotes) that still remain even unaddressed within the traditional biological paradigm.

12

Conclusions: Can the Biosphere Be Treated as a Resource?

Humans are unique in the living world. Unlike all other species, humans are able to accumulate cultural heritage, which is transmitted to following generations. Accumulation of cultural heritage is not only a unique ability of *Homo sapiens* individuals, but one of their natural needs encoded into the species genome. The development of cultural heritage cannot be stopped. Were the cultural information cease to accumulate, that would mean termination of the existence of the *Homo sapiens* species.

An inherent component of the development of cultural heritage is scientific and technological progress. Its modern rate can be characterised by the average time of replacement of major technologies, which is now of the order of several years. The corresponding natural process of replacement of biotic 'technologies' (i.e. the ways of the biota's organisation and functioning) is characterised by the average evolutionary time of complete change of the genetic programmes of the extant species, which is of the order several hundred million years (Chapter 11). Thus, the contemporary rate of scientific and technological progress exceeds the rate of evolutionary progress by 7–8 orders of magnitude. Any possibility of sustainable development of the biosphere in pace with the development of humanity is therefore unthinkable. The misleading idea of such a possibility is based on erroneous identification of relatively rapid processes of decay and relaxation of the genetic information of natural biota (including artificial selection of domestic plants and animals) with natural evolutionary processes (Chapters 9, 10 and 11).

Thus, humanity is facing two contradicting phenomena—the inevitability of development of civilisation and the impossibility of an equally rapid development of the biosphere. In other words, while civilisation develops, the biosphere degrades. To solve the contradiction, one needs to confine civilisation's development within such limits that would make it possible to ensure the safe existence of the biosphere, i.e. the biota and its environment. In order to do it, one needs to quantify the permissible threshold of anthropogenic perturbation of the biosphere beyond which the biotic regulation of the environment ceases to operate on a global scale and global environmental changes commence. This threshold, in the first approximation, was found in this book in several independent ways (Sections 3.7; 4.6; 6.4; 6.5). It was shown that anthropogenic environmental impact is completely determined by the world human population number (Figure 6.5). Thus, the only limit that should be imposed on the development of civilisation is that the world population number of humans should not exceed the threshold value beyond which the biosphere starts to degrade on a global scale.

The existence of the modern world population is owed completely to the continuous progress of science and technology, which enables humans to accelerate the process of cultivation of the biosphere envisaged by humanity as but one of the environmental resources. With growing population density the *per capita* energy consumption inevitably increases (see Figure 12.1). It is therefore impossible to achieve a considerable reduction of anthropogenic energy consumption on a global scale at fixed population density. This means that the way towards sustainability does not lie through reduction of consumption of developed countries. Division of the modern world into developed countries with high *per capita* consumption and anthropogenic environmental impact and developing countries with lower *per capita*

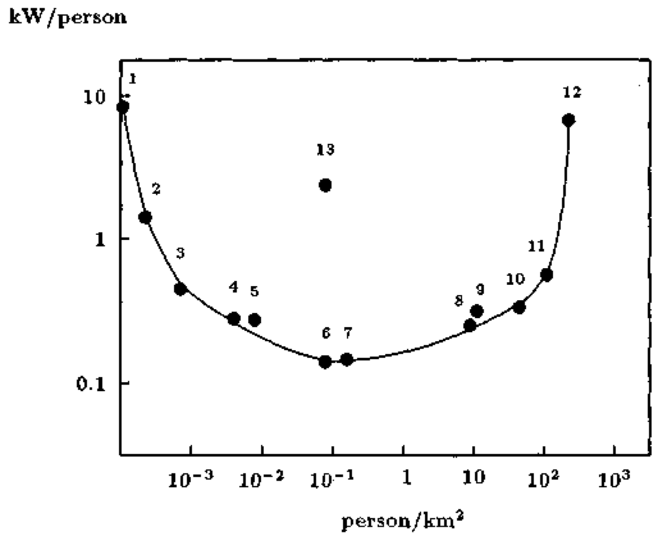

Figure 12.1. Anthropogenic *per capita* energy consumption in relation to population density. Figures stand for different energetic modes of human existence on a normal diet (i.e. not starving). 1 – motorised hunting; 2 – hunting on horseback; 3 – modern hunting by Eskimos; 4 – primitive hunting; 5 – primitive animal husbandry; 6 – primitive fishery; 7 – foraging; 8 – animal husbandry on pastures; 9 – primitive slash-and-burn agriculture; 10 – modern slash-and-burn agriculture (Tsembago); 11 – traditional agriculture (Russia, year 1897); 12 – modern world as a whole; 13 – motorised ocean fishery (Gorshkov, 1980; Gorshkov, 1995). *Note that per capita energy consumption is rigidly correlated with population density.* At a given population density the per capita energy consumption cannot be reduced. It can be only increased, as, e.g. in the case of motorised fishery – the most inefficient way of food consumption in the human history. Any species (humans are not an exception) is adapted to its natural ecological niche. Stable existence of a species outside its natural ecological niche requires additional energy expenditures. The greater the deviation of environmental conditions from the natural ecological niche of the species, the greater energy expenditures are needed to support life of the species individuals. Hence, hopes for reduced energy consumption of the humanity at sustained current global population number, are unjustified.

consumption and anthropogenic environmental impact is caused by the unevenness of the technological progress. Some countries develop quickly, others more slowly, but growth of consumption is common to all of them.

In the meantime, the observed degradation of the environment on both local and global scales is not due to the global economic and population *growth*. The already existing world human population goes beyond all possible ecological limits. It is insufficient simply to stop population growth. To solve the ecological problems of humanity, a significant reduction of the global population number is absolutely indispensable. Whatever is contemporary people's attitude towards negative population growth, this problem will have to be solved on the basis of the cumulative scientific potential of the humanity involving knowledge of ecological, genetic and social properties of *Homo sapiens*.

In this book we quantified the threshold value for the world population number beyond which global changes started (Figure 6.5). It is of the order of half a billion people. On a local scale, the threshold population density was exceeded long before the cumulative world population reached that value. There is no doubt that the information about the ecologically permissible species population density in humans, as in all other species, is encoded into the species genome and determines peculiarities of human behaviour in overpopulated areas. By all appearances, the critical population density of humans was reached when massive bloody wars were first registered in the history of humanity, a phenomenon never observed in any other biological species under natural (!) environmental conditions. In no natural biological species do adult individuals kill each other in masses, as humans do (Tinbergen, 1968). This indicates that humans have been living locally in distorted environmental conditions of overpopulation for at least several thousand years.

During thousands of years different countries have been competing for the territorial and material resources of the biosphere using military wars as the major way of competitive interaction. The bravest soldiers who killed the largest number of enemies enjoyed high social prestige. The greatest countries were those having the largest number of colonies. Wars undermined the power of the belligerent countries, but practically did not affect the rate at which the biosphere was being destroyed.

At the present time, colonies and large-scale military wars have become a thing of the past. They have been replaced by no less cruel economic wars which are aimed, as ever, at gaining control over biospheric resources. The highest social prestige is now associated with businessmen who have been able to use the largest amount of resources and gain the highest profit. Economic wars are not accompanied by visible loss of human lives, so they prove to be the most efficient way of resource use and cause the quickest possible degradation of the biosphere. The unconscious aggressive desire of *Homo sapiens* individuals to struggle with overpopulation by killing their conspecifics, that had been catered for during the historical period of global wars, is now satisfied in virtual reality, which is the only explanation of the unprecedented popularity of violence in the videos and computer games of the modern world.

The traditional global process of plundering the biosphere may be stopped only when people realise that the biosphere is not a resource to be used to increase personal or national wellbeing. In very much the same manner as modern ethics prohibits economic growth based on the sale of slaves, drugs and human organs, the future ethics of humanity is sure to prohibit extensive cultivation of the biosphere. Civilisation can and must develop, but not at the expense of the biosphere, which is the only guarantee for long-term global environmental stability. The development of civilisation in the direction of further cultivation of the biosphere should be stopped.

Such limitation of civilisation's development does not represent a constraint of human rights or individual freedom of human beings. Humanity has long ago got used to *physical constraints* imposed on human activities by the laws of nature. Nobody's personal freedom is violated by the fact that it is impossible to move at a speed higher than that of light, that it is impossible to construct a perpetuum mobile or by the fact that any individual life has a start and an end. Apart from these, there is a great number of *juridical constraints* on human activities that are written in human laws and aimed at maintaining stability of the modern, overpopulated world. The majority of these laws are never treated as a threat to human rights or personal freedom. Similarly, *ecological constraints* on human activities, when properly and clearly explained to the population, will not present any threat to human rights. These ecological constraints will govern the long-term stability of the existence of humanity on our planet. It is necessary to incorporate the knowledge of ecological constraints into the education system of modern humanity. Were people to observe the ecological constraints, the necessity of many contemporary constraints will be relaxed. In modern society, there are no laws that prohibit jumping from skyscrapers, because such constraint is already inherent to the genetically-encoded normal behaviour of humans. Similarly, there will be no necessity for laws prohibiting wars in a world with normal population density. Under conditions of their natural ecological niche, humans should be as incapable of killing their conspecifics as all other natural biological species.

The contemporary ecological problems of humanity are due to the fact that scientific investigation of the ecological constraints on civilisation development began very late in human history. People have been living too long in the imagined comfortable world of the unlimited possibilities of exploring natural resources of the Earth and space. People have been too long convinced of the principal inevitability of non-stationary development of the civilisation following the non-stationary development of the Universe itself (Shklovskii, 1987). The most important ecological problem of today is how to reduce the current level of the anthropogenic perturbation of the biosphere down to the threshold level compatible with long-term environmental stability. The problem is so non-trivial and unconventional that people are often unconsciously unwilling to admit the very existence of ecological constraints on economic and population growth.

The world human population has been exponentially growing since the middle of this millennium. Such demographic explosion became possible as a result of the economic growth based on scientific and technological progress. Since many generations of humans have already been existing under conditions of exponential economic growth accompanied by anthropogenic transformation of the biosphere, the very phenomenon of growth and non-stationarity is perceived by people as a natural state of affairs. Exponential economic growth is manifested in positive annual increments in industrial production, bank deposits and values of securities, which is regarded as an indispensable condition of people's existence.[1]

Industrial production is based on consumption of certain types of energy and matter known as natural resources. Non-renewable resources are those not used by the biota and not involved in the biochemical cycles, i.e. mineral ores and fossil fuels. The so-called renewable resources are solar energy and production of the biota itself.

The existence of limits to economic growth related to complete extinction of non-renewable resources and approaching the natural limits of consumption of renewable resources were convincingly demonstrated to the world community in a series of papers of the Rome club (Meadows *et al.*, 1972; 1974; 1992; Mesarovic and Pestel, 1974; Tinbergen *et al.*, 1977; see also Gore, 1992).

However, in all these papers the biosphere, i.e. the global biota and its environment, was treated from the economic point of view as but one of the available types of resources. It was assumed that the anthropogenic pollution of the environment was to be counteracted by adequately compensating human activities, which, as well as all the other types of human activities, were to be based on consumption of natural resources. The question of whether it is at all possible to keep the global environment stable by technological means did not even arise. The question of natural limits to the biospheric stability and the existence of biotic regulation of the environment was completely ignored as well.

Until the present time the problem of human population growth has been almost exclusively related to the task of feeding the global population on the basis of exploitation of renewable resources (Bongaarts, 1994; Daily *et al.*, 1998). The so-called optimistic forecasts are based on the fact that at present humans are only consuming about 10% of the net primary production (a renewable resource) of the biosphere (Figure 1.1). It is then concluded that, on the basis of the law of matter conservation, the global consumption and, hence, world population can be increased by an order of magnitude. However, renewable biospheric resources only remain renewable until the anthropogenic share of their consumption does not go beyond the threshold of biospheric stability. When the threshold is passed, renewable resources become non-renewable. On the other hand, were the consumption of renewable resources to remain below the ecological threshold, the very notion of resource loses its meaning (see below and Section 5.7).

Economic growth of free market economies is based on the possibility that a businessman finds an area of capital investment and production of goods which will be in demand and bring profit. The profit is then used for the personal enrichment of the businessman and the workers, on the one hand, and further expansion of the business, on the other. As a result, the industrial production, as well as the businessman's welfare, grows exponentially and may take a much shorter time than the human lifespan. The welfare of the businessman determines his social prestige in the human society, i.e. increases his competitive capacity. To increase the individual competitive capacity is an inherent desire of any living being. Stability of life is solely maintained because of this unique property of living matter (see Chapter

[1] A constant relative increment of any variable indicates its exponential growth.

2). Thus, prestige determines all the actions of the businessman and promotes economic growth. Socialism and centralised economic planning has lost the competition with capitalism and free market economy because this basic genetically-programmed instinct of humans was not paid sufficient attention within the socialist system. Those who worked hard and those who worked little were equally paid and, hence, were equally competitive in the society.

Production of anything is in its essence an ordered process maintained at the expense of external energy. Goods are ultimately produced from raw materials regarded as natural resources. Thus economic growth is inevitably followed by extensive cultivation of the biosphere. A free market makes it possible to effectively balance the offer and the demand, determine relative prices of all goods and introduce their money equivalent. Economic growth is the cornerstone of modern economic science, which completely loses any sense were the notion of growth eliminated from it (Leontieff, 1977). Economic growth is manifested in increasing rates of production of goods and, consequently, their money equivalent. The latter value is considered all over the world to be the major indicator of living standards. Thus, politicians in all countries tend to enhance economic growth by all available means, economic stagnation being the worst of all possible evils (Gore, 1992).

Any living organism in the biosphere is genetically adapted to its natural ecological niche. By definition, all organisms feel most comfortable under environmental conditions that are as close to the natural ones as possible. For the overwhelming majority of humans, such desired existence is only possible during leave when they are freed from work for a sufficiently long period of time. In most countries, yearly leave does not exceed 2–4 weeks, which is no more than 10% of the average lifetime. Thus, an average 70-year-old person has spent only seven years under natural environmental conditions. However, with the increasing degree of anthropogenic transformation of the biosphere fewer and fewer environments can be considered as close to the natural ecological niche of humans. The remaining natural areas begin to acquire high market value available to rich people only. One of the most expensive is the possibility of spending some time under conditions of low population density. Only the richest people are able to spend their free time on nearly uninhabited tropical islands. The overwhelming majority of humans have to spend most of their lives under unnatural environmental conditions distorted by civilisation. In a completely transformed biosphere it will be impossible to buy normal conditions of existence for any sums of money.

Hence, intensive work of modern people is ultimately aimed at transformation of the natural environment into a comfortable prison cell with the highest possible rate of per capita consumption of all possible goods. Prison, however comfortable, cannot substitute for the natural environment and cannot be associated with high living standard. Neither can such work constitute the meaning of human life.

It is often assumed that the question of the meaning of life is very complex, possibly unscientific and ambiguous. However, all the time people return to this question, which in itself is a scientific fact that calls for explanation. The meaning of human life includes necessary work aimed at reproduction and genetic stabilisation of the *Homo sapiens* species. That was evident to humans at the very moment of the

origin of *Homo sapiens*. Were that not the case, there would be no humans and no such question. During the last several thousand years it has become evident that the meaning of human life also includes necessary work on stabilisation (i.e. preventing from decay) of culture and civilisation. Finally, during the last several decades it becomes evident that the meaning of human life also includes, as one of the major tasks, necessary work on stabilisation of the biosphere, i.e. the environment and the natural biota. Human culture cannot develop independently from this work and should be completely subordinate to the latter. Otherwise, as well as in the case of stopping reproduction and genetic stabilisation of the species, there will be no humans and no question of the meaning of life at all.

The meaning of life of individuals of all natural biological species is not reduced to existence in a given environment, adaptation to it and consumption of its resources, as is usually thought. Among all possible biological species that are capable of existence on Earth, the biota has selected only those that are also capable of performing strictly specified work on the stabilisation of their own environment in close cooperation with other species of their ecological community. Mechanisms of such selection are described in Chapter 5.

In locomotive animals, the strategy of necessary actions aimed at environmental stabilisation is genetically programmed as the system of positive and negative emotions. The meaning of life of any individual is to follow positive emotions and avoid negative ones. The tactic diversity of possible actions determined by the genetically-programmed strategy is dictated by information of individual memory which accumulates during the whole lifespan of the individual. In humans, the natural tactic realisation of the strategic programme of positive and negative emotions is considerably masked owing to the presence of artificial cultural information and requires a detailed scientific analysis. All the available evidence testifies for the statement that the meaning of human life cannot be principally different from that of all living beings of the rest of the natural biota.

As discussed in Section 6.7, the natural ecological function of large animals, including *Homo sapiens*, is to regularly introduce perturbations into the ecological community in order to create environments suitable for existence of so-called species-repairers, i.e. those that restore the environment after large-scale environmental perturbations. One of the modern manifestations of such destructive character of genetically-programmed natural human behaviour is the fact that the majority of people enjoy scenes of explosions, fires, catastrophes, which is extensively used by film producers. Had it not been the case, films showing catastrophes of all kinds could have not dominated the modern video market, as they now do.

However, in natural communities the population density of large animals is kept at a low level, so that their destructive activity (which is useful for the community in small doses) does not go beyond permissible ecological thresholds (Figure 3.3). Development of cultural heritage has provided humans with powerful tools of transformation of the biosphere. However, the basic strategy of human behaviour has remained unaffected by culture. As a result, with increasing population density of humans, the destructive anthropogenic forcing went far beyond the ecological threshold and gradually transformed into the global process of degradation of the biosphere which threatens the existence of life as a whole. It is time to remember that, apart from genetic information governing behaviour of individuals of all biological species, humans are in possess of cultural information that both can and must impose limits on instinctive destructive behavioural strategies of humans, stop the degradation of the biosphere and return humanity to a state of global stability.

While people certainly need to spend some time in the artificial environment of their civilisation, the total area affected by civilisation should constitute a small part of the area occupied by the natural non-perturbed biota. Most part of the work performed by humans should be aimed not at extensive development of civilisation, but at conservation of the natural biota in its non-perturbed state below the limit threatening the stability of the biosphere as a whole.

Functioning of natural biota is not based on consumption of environmental resources. The environment itself is prepared by the biota and maintained in the optimal for life state. Destruction of whatsoever substance in the biosphere is compensated by its production. All ordered processes in the biota work on a cyclic basis. Thus, there is no such notion as resource or limiting resource for the natural biota in the biosphere (Section 5.7).

Free competitive interaction of conspecific individuals in the natural biota serves as a tool of elimination from the population of decay individuals with impaired genetic programmes that destroy the existing optimal environment. In a natural ecological community there is no place for species-gangsters with all their individuals disrupting the correlated community structure and preventing it from performing regulation of the environment. Individuals of such species-gangsters do use the biota and the environment as a resource, not caring about the consequences. The consequences are disintegration of the community that gives shelter to the species-gangster, violation of biotic regulation and degradation of the local environment. As a result, the community loses competitiveness and is forced out from the biosphere (i.e. becomes extinct together with the species-gangster) by normal communities resistant to species-gangsters.

Hence, the notion of resource has no meaning for the self-regulatory system *community – its environment*. As soon as there are no resources, it is impossible to compete for them or privatise them. Similarly, it is impossible to divide conspecific individuals into the rich, i.e. those having property and governing the resource use, and the poor, i.e. those deprived of property and incapable of using resources. Under natural environmental conditions, decay individuals prevented from reproduction or suppressed in any other way constitute a negligible part of the population. The overwhelming majority of the population is represented by normal, equally-competitive individuals capable of performing equal amounts of work on the stabilisation of the environment and consuming equal amounts of life-necessary goods from the latter. Environmental conditions of the natural ecological niche of any species provide for 'democracy' and equal rights for the overwhelming majority of individuals in the population, these individuals working themselves on stabilisation of such optimal environment.

Under distorted environmental conditions, competitive interaction among conspecific individuals is weakened or completely switched off, so that decay individuals may accumulate and form the majority (Chapter 9). Decay individuals are incapable of performing the necessary work on stabilisation of the environment. To return the population and, hence, the environment, to the initial state, the remaining minority of normal individuals should nevertheless be able to govern the population. In such a situation, 'democracy' that equals normal and decay individuals is absolutely inadmissible. It would only work to further increase the number of decay individuals and, by doing so, facilitate loss of genetic information of the species and increase the probability of the species' extinction.

Being meaningless for the stable biosphere, the notion of resource acquires a meaning for any degrading system during the finite time of its degradation, e.g. when a species-gangster is introduced into an ecological community. Species-gangsters do not contain genetic information about the necessity of ensuring stability of the community and its environment. When several species-gangsters are introduced into the community, they may begin to compete for one and the same resource. Such rivalry of gangsters reveals the most competitive ones, i.e. those capable of using the resource at the highest speed and, hence, destroying the system in the shortest time. Such rivalry has nothing to do with the natural competitive interaction of conspecific individuals aimed at elimination of decay individuals destabilising the community and its environment.

Legal economy of the modern world considers the biosphere as one of the major resources of humanity and cannot avoid destroying the natural biota and the global environment. In comparison, criminal structures envisage the legal economy and civilisation itself as their resource. The legalised economic methods of plundering of the biosphere do not differ in their essence from legally prohibited actions of economic criminals. Competition of legal businessmen for the most efficient use of natural resources has much in common with rivalry of criminal structures dividing their zones of interests in using the resources of civilisation. Criminal structures destroy civilisation. Legal economy destroys the biosphere. The object of plundering is different, the methods are nearly the same. In the meantime, degradation of the biosphere would mean disappearance of the natural ecological niche of humans, which cannot be compensated by whatsoever high *per capita* rate of production of goods.

Humanity has learnt long ago that in order to keep society healthy and competitive, one needs to keep activity of criminal structures below a certain critical level. Consumption of criminal structures should not exceed a certain small share of the gross economic production of civilisation compatible with stable existence of the latter. In very much the same manner, stable existence of the biosphere and, ultimately, of the civilisation itself, is only possible when activity of civilisation does not go beyond an ecological threshold.

As shown in this book, stable existence of civilisation is only possible when the anthropogenic share of consumption does not exceed 1% of the net primary production of the biosphere. This estimate has been obtained by several independent ways using

(1) data on the global carbon cycle (Sections 6.4 and 6.5);
(2) data on the distribution of consumption over heterotrophic organisms of different body size in natural ecosystems (Section 3.7);
(3) data on the rate of diffusion of the excreta of large animals under natural environmental conditions (Section 4.6).

The present-day direct anthropogenic consumption of the net primary production on land is of the order of 10% exceeding the permissible ecological threshold by an order of magnitude (Sections 6.4 and 6.5). The cultivated part of land perturbed by the modern civilisation in one way or another constitutes more than 60% of the total land surface (Gorshkov, 1980; Vitousek *et al.*, 1986, 1997; World Resources, 1988).

A balanced reduction of the anthropogenic consumption of the biospheric production down to the ecologically-permissible level can be only performed as a result of reduction of the world human population approximately to the value observed in the beginning of the 18th century (Section 6.4 and Figure 6.5). Such reduction can be performed over a time period not exceeding a century following the one-family-one-child pattern in family planning. Were such reduction to be performed, the restrictions on the living standards of people related to over-consumption can be relaxed. Gradual reduction of the world population can thus be accompanied by continuously increasing living standards in all countries. It does not violate human rights and commonly accepted ethical norms. To return to the state of stable civilisation in a stable environment one only needs to overcome the non-scientific conservatism of the traditional attitude towards depopulation common to professional politicians, demographers, economists and the mass media. People should finally learn to treat the future generations with true (instead of declarative) respect and begin to really care for their interests, as all natural biological species do by maintaining stable environmental conditions in their ecological communities.

The global strategy towards depopulation can be accompanied by tactic measures causing more immediate improvement of the global environment. Modern forest exploitation represents one of the most serious threats to the environmental stability of today. Forests represent one of the most productive types of ecosystems encountered in the biosphere. When non-perturbed, they perform the largest amount of work on biotic regulation on land. Paradoxical as it is, the regulatory mechanism of forests that is vitally important for the whole of humanity is now being destroyed by a few per cent of the world's working population. Forest industry as a whole contributes not more than a few per cent to the Gross World Product (World Bank, 1997). Thus, complete abandonment of forest use could not significantly disturb the world economic system.

In the meantime, modern exploitation of forests leading to complete degradation of natural forest communities on the remaining large forest-covered territories, completely undermines the biotic regulation of the environment on all continents. Natural forests cannot be considered as a resource belonging to individual businessmen or even nations. The soonest possible prohibition of forest use and subsequent protection of forests by the united world community may give hope for the sustainable development of civilisation in the future. Immediate improvements in the water cycle, and many other components of the environment on a regional scale after restoration of natural forests, will benefit those countries where the forests are situated. The subsequent global improvement of the environment (e.g. with respect to the carbon cycle, Section 6.5) could compensate economically those relatively small economic losses related to stopping forest use. Those countries that are deprived of forests but benefit from the global environmental improvement will be able to compensate economic losses to the countries that will have stopped forest use. It is high time that the world community takes coordinated measures in this respect.

As shown in Section 6.5, the modern carbon cycle change and accumulation of CO_2 in the atmosphere can be stopped even if the modern rate of fossil fuel burning remains unchanged if the modern forest exploitation were reduced by approximately 40% on a global scale and natural forests were restored on previously-exploited territories. Note that only natural forest communities are able to perform biotic regulation of the environment. Plantations and managed forests are deprived of such ability and, on the contrary, contribute to the anthropogenic perturbation of the environment (Section 6.5). We speak therefore about restoration of the natural regulatory potential of the terrestrial biota achieved by restoration of natural forests, which has absolutely nothing to do with fixation of a certain amount of carbon in industrial wood, as it is sometimes proposed.

Were forest use reduced by the above value, further gradual reduction of the global world population can be prolonged over time and performed without imposing any undesirable effects on the world population. In other words, natural forests will give the people time to return the planet to the state of maximum possible environmental stability and restore the maximum efficiency of the biotic regulation on a global scale. Hence, humanity does have a real opportunity to overcome the global ecological crisis and restore the stability of favourable (for humans and life as a whole) environment on our planet.

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