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The popular climate change and the illusion of ecosystem stability. How to react on the dynamics of Nature?

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Abstract:

Climate change will be the greatest environmental challenge facing future generations unless we stop overstressing the carrying capacities of the world's terrestrial and marine ecosystems. The over-exploitation and over-consumption of fundamental natural resources will increase day by day and human environments with their vital infrastructure for sources supply, traffic and living conditions in complex settlements are getting more and more sensitive against the normal dynamics of nature, especially abrupt changes of weather. Additionally to the normal and natural dynamics of weather and climate, anthropogenic impacts on the climate system may exacerbate the effects and intensities of weather events. To encounter these challenges the development of adaptation and risk prevention strategies have to be one of the most urgent aims of decision makers all over the world.

Introduction:

I would like to start my contribution with a citation:

- "*No country is immune to climate change, but the developing world will bear the brunt of the effects, including some 75 to 80% of the costs of anticipated damages. Millions in densely populated coastal areas and in island nations will lose their homes as the sea level rises, while poor people will face crop failures, reduced agricultural productivity, and increased hunger, malnutrition, and disease. Extreme events such as droughts, floods, and forest fires will become more frequent, making it even harder for developing countries to attain the United Nations' Millennium Development Goals of 2015. etc.*"

This is the conclusion of a scaremongering article in Science of Nov 2009, written by Rosina Bierbaum and Robert Zoellick. Following these statements, catastrophes now seem in-escapable.

Very probably, climate change will be the greatest environmental challenge facing future generations unless we stop overstressing the carrying capacities of the world's terrestrial and marine ecosystems. While the change of climate will have positive effects for certain regions, it will cause disadvantages for others, much in the same way than in more remote times of history. However, the current impact of climate change on natural resources, social, economic

and environmental conditions will be by far of greater relevance for human societies than ever before, not at least because of the exponential growth of the world population. My contribution will focus on these two dynamics:

1) the population growth and the increasing demands it generates, and
2) the everlasting climate change, the so-called modern global warming.

We have to accept the fact that none of these developments can be avoided or influenced in the medium term. However, we have to adapt and to react on these challenges. Environmental protection, adaptation to the dynamics of climate and weather conditions, and the sustainable use of the regional and global resources should be the most important activity for the future.

Since 1804, the world population increased from one billion to presently 6.8 billion, and will reach - according to the UN - 9.2 or 10.8 billion in 2050. This development is absolutely unique. It will lead to a staggering demand on resources, e.g. food production including an increase of agricultural areas, and of water consumption. There will be also a greater demand for energy to supply for the growing industries, especially in developing countries. The greatest problems in this context will occur in areas with particular high population growth.

Unlike the dramatic growth of the world's population, climate changes are completely natural phenomena which have affected human history from time immemorial. Let me illustrate this with a few examples. During the Last Glacial Maximum (LGM) about 18-25 thousand years ago the world's sea level was about 130 m lower than today. The areas exposed as terrestrial ecosystems with an extremely high biodiversity were altogether larger than the continent of Australia. Islands in many parts of the world disappeared over time, and others were strongly reduced. In comparison, since the end of the Little Ice Age the sea level has raised continuously nearly 20 cm (7mm/y). Additionally, dramatic isostatic dynamics took place also in modern times at the northwestern European coasts. Thus for example, large parts of the low-lying Netherlands are located below the sea level, protected by large dikes. Nowadays *"this area is home to over 60 percent of the country's population of 15.8 m."* [2]

The world has altogether experienced several warmer and colder, as well as humid and dry periods in different areas. This is a permanent feature of nature. Such changes, that often took place in a very short timeframe, occured also during our actual interglacial phase. The state-of-the-art science thus "*virtually destroys the old idea that our climate changes little and slowly between Ice Ages*" (Singer & Avery 2008: 22).

Taking into account these changes, we can summarize that nature has never been at any equilibrium. This idea has never been more than a pious desire, unfortunately often also cherished by scientists. In this context it is necessary to remember that the idea of paradise is nothing else than a fenced garden where all our problems are locked out. It is the result of the old knowledge, that the change of environmental conditions is natural and a constant threat.

The current trend to ascribe every change in our environment to the change of climate, which is characteristic not only for the media, is a dangerous simplification because it prevents any anticipatory ecological and economical decisions based on the knowledge that nature is unpredictable.

Climate Change and Population Growth

As already mentioned, climate change has and will have a tremendous impact on human beings. The post glacial climate change has been the precondition for the success of human cultures. Especially, the transition from nomadism to sedentary life with crop cultivation and the domestication of animals was one of the key dynamics in this process. This shift takes place during the Neolithic period at the beginning of the early Holocene.

The overall history of cultural development was attended by climate optima and pessima, and had always an enormous impact on human cultures. They brought about the rise and fall of whole cultures and caused large population movements, especially in the northern hemisphere.

All these changes of climate occured without any human interference. The change of climate from the Medieval Warm Period with temperature conditions comparable with the modern situation to a more or less uncomfortable environment with cold and long winters and rainy summers in the northern hemisphere during the Little Ice Age is wellknown. Although, today's climate cannot be called dangerous, it should be clear that changing weather conditions have been dangerous in the past for human life, as well as today, and will be more dangerous in the future because of several reasons which will be discussed later.

The ongoing discussion about the reasons of the actual global warming, often misleadingly labelled as Anthropogenic Global Warming (AGW), will be not commented in the framework of this contribution. The IPCC storylines are storylines of high political relevance. I absolutely agree with Schultz (2008), one of our outstanding ecologists that current estimations of the consequences and the dynamics of the actual climate change are dominated by selected expert opinions, expert elicitations or evocations, and good instincts of leading climate scientists. And some publications are mainly based on gut instincts (e.g. Zickfeld et al. 2007, Lenton et al. 2008). However, instead of relying on assumptions that are often also influenced by political implications we should better trust scientifically proven facts.

The dramatic growth of the world's population together with the great population density in vulnerable areas with all unavoidable consequences is, in my opinion, the greatest danger that faces humanity in the near future. Already the Global 2000 Report pointed out that as a result of the increasing population the world will be more vulnerable to disruption, serious stresses involving population, resources and the environment. The people will get poorer and poorer in many ways.

The reasons and consequences are closely related to changes of climate or of weather conditions, since our civilisation is not prepared for any adaptation to the natural variability of climate. It should be kept in mind that nowadays nearly 70% of the world population lives near endangered coastal low-elevation zones vulnerable to floodings and intense storms. And populations in coastal areas are growing faster than those in noncoastal areas.

We have to accept that the increasing human impact on nature with its fundamental resources has "*changed ecosystems more rapidly and extensively than in any comparable period of time in human history, largely to meet rapidly growing demands for food, fresh water, timber, fiber, and fuel."* (Millennium Ecological Assessment, 2005). It is the result of the activities of humans

to survive. We have shaped the earth according to our needs regardless the natural environmental dynamics and the long-term sustainable use of our ecosystems.

Nevertheless, we should not underestimate any dynamics related to climate change, especially because our modern civilisation is absolutely dependent on stable environmental conditions. The same is true for agricultural production conditions for special cultivated crops in certain parts of the world. One third of the American economy is dependent on weather conditions, especially agriculture, tourism, trade, energy and the insurance industry. It might be interesting that insurance agencies have observed an increasing number of storms, floodings etc. in the last years. In contradiction scientific observations and analysis do not agree with this estimation (Majewski et al., 2004, Muddelsee et al. 2003)

The necessary expansion and intensification of agriculture to feed billions of people, the transformation to pasturage and farmland, or destruction of forests especially in tropical and subtropical countries, the overutilization of sweet water (especially rivers or groundwater in semiarid and arid areas) or fertile soils, and other global resources to satisfy the growing primary and consumer needs, will lead to shortages and conflicts between countries, but also between global operating private entities.

The vegetation degradation and the ground water resources exhaustion can be observed as typical results in semi-arid and arid areas. Food scarcity, increasing poverty and migration dynamics, in parts resulting from limited resources will be not only a phenomenon of the future. That is the reality of today, of our modern world.

The United Nations High Commissioner for Refugees (UNHCR) reports that as of December 2006, there were at least 22.7 million people displaced, including 9.9 million refugees and 12.8 million internally displaced persons (UNHCR 2007). Moreover, according to a report of the World Health Organization from October 2009 nearly 1 billion people suffer from chronic hunger, which is more then ever before. [1] It is clear that the most serious problem will be "*the Malthusian question of how to raise food production by the required 70 per cent by 2050?*" (FT, Sept.26/27, 2009). FAO Director-General Jacques Diouf said that "*the combined effect of population growth, strong income growth and urbanisation … is expected to result in almost the doubling of demand for food, feed and fibre*". On this background the statement of Lester Brown from the Earth Policy Institute is of great importance that since the 1980s we observe the dangerous ecological and socio-economical development that the world's grain production fails to meet the populations' need.

The dramatical water scarceness in semi-arid and arid areas where the discharge of groundwater is larger than the recharge as a result of artificial irrigation will be one of the greatest challenges of the future. As Fred Pearce has recently pointed out " *the world water problem will be of larger relevance then CO2-problem*". This observation is in accordance with the findings of the UN World Water Development Report, Water for People - Water for Life (2003). Moreover, the observable decline of fertile soils in many regions of the world is mainly the result of overutilization, and only to a very small part of the present climate change. It can lead to a collapse of the food production in certain countries with the predictable result of famines.

Another problem refers to the widespread agricultural practice of monocultures for food or timber production**.** Very often, such monocultures consist entirely of non-indigenous plants. They were established in a very short time-frame according to the then actual climate conditions without taking into account the variability of the long-term natural side conditions.

Under these circumstances, only minor changes of meteorological conditions will have dramatic effects on weather sensitive plants, artificially adapted to certain habitats in order to reach a maximum yield. Although new designed food can be a great advantage to increase the food production, the conditions of growth for genetically modified plants are constrained.

All these developments, which are real and measureable, could result in a disaster for the whole mankind. However, the catastrophe is not inevitable. It is the result of ignorance, short-term thinking and ecological incompatible economic systems, rather then of the climate change itself. They can be observed also in OECD countries. But we should not fail to recognize that 97% of the world population growth takes place in developing countries or in newly industrializing economies. In this context it is necessary to emphasize that today half of the world's wealth is in the hands of the richest 2% of the population, and 20% of the world's population consumes 80% of its resources.

As already pointed out, the climate is changing, and has done it several times in the past. Millions of people have been victims of flooding, storms, drought and heat in former times. And in the history of human beings people were often forced to leave their settlements or native countries. And it should be clear that in modern times it is extremely difficult to escape from unfavorable environments.

Ecosystem degradation and overexploitation takes place all over the world. The reasons are manifold: land cover change, introduction of new agricultural technologies, the modification of water regimes, and soil and water pollution. Social misery, unemployment and hunger are the consequences. In this context, speaking about climate refugees is completely misleading and a deception of the real causes and effects.

The development of strategies for adaptation and prevention

According to the environmental economist Richard S.J. Tol (2006) "*the Stern Review* (on the economics of climate change) *is very selective. It quotes on the impacts of climate change* (and) *can therefore be dismissed as alarmist and incompetent*". The economical and ecological impacts of an unrestricted world population growth are not mentioned in the text.

However, one has to agree Storch (2004) and others when they stress that the timely development of adaptation and prevention strategies is much cheaper than to do nothing. The greatest challenge will be to find solutions which empower people of developing countries to participate in consumption and wellbeing in a healthy way. The Biodiversity and Action Plan on Climate Change Adaptation of the European Commission is one of the progressive tools to reach these aims.

One of the greatest challenges will be to stop the exponential growth of world population in order to reduce the possible impacts of climate change on natural resources (Short & Potts

2009). *Every extra individual on our planet consumes resources and adds significant carbon dioxide to the atmosphere, even if he or she lives in the poorest part of the world where population are growing fastest (…). A study at the London School of Economics* [5] *found that spending on basic family planning was five times more cost effective at cutting carbon dioxide emissions than conventional low carbon technologies."* (FT Sept. 2009 according to Wire 2009)

Furthermore, we have to abandon mindless production and excessive consumption of goods and food typical for the so-called developed countries. The consumption mantra gives rise to over-exploitation and over-consumption of fundamental resources and to their thoughtless waste. All these developments have already brought about shortages of water and food, and increasing prices for energy, as they also made whole populations dependent on the import of basic resources. Several large rivers are reaching the sea only as small wastewater runnels and large inland lakes are shrinking to puddles in arid areas. The underground aquifer of large landscapes in Africa, Arabia, and India are drying out. And this is also not the result of climate change. In order to enable equal access to water resources, the implementation of fair transboundary water management systems would be necessary.

The third vital necessity of our time refers to the different carrying capacities of ecosystems. It is surely well-intentioned but fundamental counterproductive to drill groundwater wells in areas where the precipitation rate is not enough to supply traditional wells, and where the yearly variation of rainfall rates is very high. The long-term average of rainfall for the purpose of water harvesting, and the groundwater discharge and recharge have to be well-balanced. The same is true for oases where the human carrying capacities are strongly depending on the natural water discharge of the aquifer. The settlement and enlargement of such fragile habitats should be allowed only after extensive integrated environmental assessments. The political motivated implementation of large agricultural areas in hyper-arid areas with artificial irrigation might be important for some reasons. From an ecologically point of view, however, such projects are unjustifiable.

New Sea Level Rise Projections under global warming suggests a rise of less than 10 cm in global sea levels, due to melting glaciers and ice caps till 2100 (Mörner 2004, Raper & Braithwaite 2006). This is far away from IPCC projections. Nevertheless, the rebuilding of settlements located in vulnerable landscapes, especially near the coast or flood plains should be part of a preventive risk management. For example, large mangrove belts of tropical coasts serving normally as protection belts against floods and hosting an enormous biodiversity have been degraded or destroyed. We should be aware that actually more than 200 million people are living in floodplains or unprotected coastal areas. And their number is increasing day by day.

Of high priority is the development of alternative strategies for energy technologies and use. The use of wind and solar energy are compatible with the sustainable use of environmental resources. The expansion of these technologies will reduce the vulnerability of energy supply and food production. In this framework the modification of the Emission Trading System is necessary to cut the power of rich countries and industries. This adjustment can stop the competitive disadvantages and possible discriminating treating of developing countries.

Resumee:

The over-exploitation and over-consumption of fundamental natural resources will increase as a result of the exponential growth of the world population. To slow down and to stop these dangerous dynamics family planning is one of the most important options, and the cheapest way to combat climate change [5]. Human environments with their vital infrastructure for sources supply, traffic and living in complex settlements are getting more and more sensitive against the normal dynamics of nature, especially against abrupt changing of weather conditions. Additionally to the normal and natural dynamics of weather and climate, anthropogenic impacts on the climate system could further exacerbate the effects of weather events.

There is no way back. Therefore the development of adaptation and prevention strategies has to be one of the most urgent aims of decision makers around the world. According to the United Nations International Strategy for Disaster Reduction (UNISDR) it is of high relevance to build "*disaster resilient communities by promoting increased awareness of the importance of disaster reduction as an integral component of sustainable development, with the goal of reducing human, social, economic and environmental losses due to natural hazards and related technological and environmental disasters*." [4] Prevention begins with verified information. Alarmism and catastrophism are counterproductive.

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