

CONTRIBUTIONS REGARDING THE MANAGEMENT OF THE EFFECTS OF GLOBAL WARMING

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A*bstract.* The paper contains analyses about the effects of global warming and climate change. The impacts of climate change may be physical, ecological, social or economic. Evidence of observed climate change includes the increasing temperature, CO₂ emissions, droughts, floods, etc. Human activities have contributed to a number of the observed changes in climate. This contribution has principally been through the burning of fossil fuels, which has led to an increase in the concentration of CO₂ in the atmosphere.

It is predicted that future climate changes will include further warming, sea level rise and a probable increase in the frequency of some extreme weather events.

Key words: global warming, climate change, extreme events, greenhouse gas, floods

Jel Classification: Q54

Introduction

Discussions on global warming often produces disputes because they generate significant effects. In this article we focus on the effects of climate change because they are more serious than they seem at first sight.

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The inclusion of global warming in the top concern of 21st century is fully justified if we consider the negative influence that it has on nature and people. According to a top of these effects made by *Life & Science*, climate changes are responsible for phenomena that range from increased risk of fire to accelerate satellites, from drying lakes and reduction of water reserves to increase allergies and diseases.

Global warming is the continuous growth in the average temperature of Earth's atmosphere and water. Global warming is caused by rising concentrations of greenhouse gas in the atmosphere resulting from human activities such as deforestation and fossil fuel burning. This warming is not disputed by scientists and policy makers, but as regards the causes of this phenomenon, there are several explanations. The dominant opinion is that global warming is due to human activity, especially by releasing carbon dioxide into the atmosphere by burning fossil fuels.

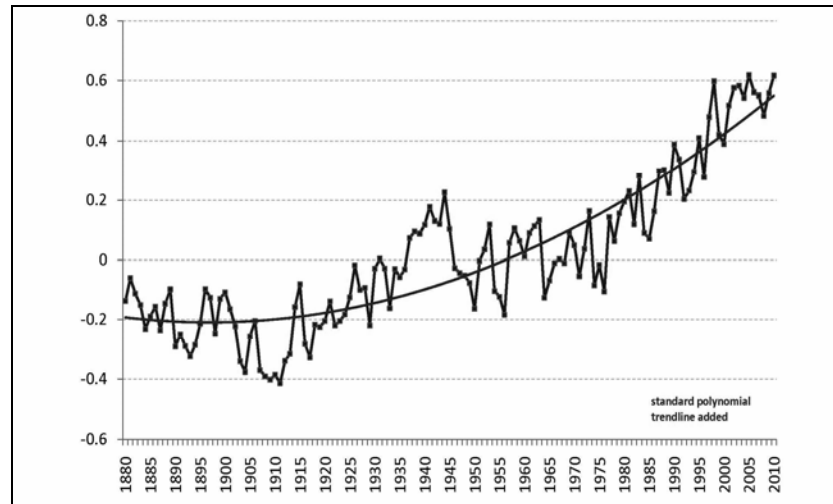
There is a natural greenhouse effect in the atmosphere and because of it life on earth was possible because it raised the surface temperature by nearly 33 Celsius degrees. But the increase in greenhouse gas concentration, like carbon dioxide, for example, in the atmosphere will only intensify this natural effect, on which it is based.

The main culprit and responsible for climate change is man. Despite of advanced technologies, 90% of energy sources are fossil fuels, which are also pollutants. We returned to the use of coal, another pollutant. Because of cars, global temperature increases approximately one degree per year. In Romania, during the last years, even if the industry has limited activity, the number of cars has doubled leading to increased pollution. In the past 50 years the urban population has increased three times, and cities are the most important polluters.

Global warming begun to cause concern after 1960, following the massive industrial development and growth in greenhouse gas concentrations, which are considered largely responsible for this phenomenon. The evolution of temperature can be observed on the schedule made by the expert in climatology Peter H. Gleick, which shows the temperature changes recorded at global level compared with the average of the twentieth century.

Climate models developed by specialists in the field estimates that the global climate will warm by 1.1 up to 6.4°C during the 21st century. The estimates vary because the evolution of gas emissions that cause the greenhouse effect cannot be predicted. Besides, the tendency of continuous warming of the planet in the 21st century is revealed by many studies in the field, but very worrying is the fact that these climate scenarios show that the polar areas will warm the most, which could have dramatic consequences.

Figure 1. Global Temperature Changes against the 20th Century Average (degrees C)



Source: http://www.huffingtonpost.com/peter-h-gleick/the-graph-that-should-be-_b_808747.html

Neither our country has escaped the extreme events, but unlike the global average, the temperature here increased by only 0.5 degrees on average. The climatological researches performed in our country have shown that during 1901-2007, the average temperature rose by 0.5 Celsius degrees, which is less than the global average, but also less than the continental average which is below one degree.

Causes of global warming at global level and in Romania

The main cause of global warming is therefore increasing concentration of CO₂ in the atmosphere over the past centuries, and experts on Climate Change (IPCC - *Intergovernmental Panel of Climate Change*) mention that since 1750, CO₂ concentration has increased by 38%, reaching 280 ppm before the industrial revolution, now 430 ppm, which is almost double, and in 2035 it could be 550 ppm if the flow of current emissions of greenhouse gas (GHG) would maintain over natural capacity of absorption.

To determine the states to reduce CO₂ emissions, the Kyoto Protocol and the United Nations Convention for climate were drawn up. The Kyoto Protocol (which aims to limit emissions of greenhouse gas) was open to ratification on March

16th, 1998 and enforced in February 2005. He has been ratified by 172 countries, with the notable exception of the United States of America.

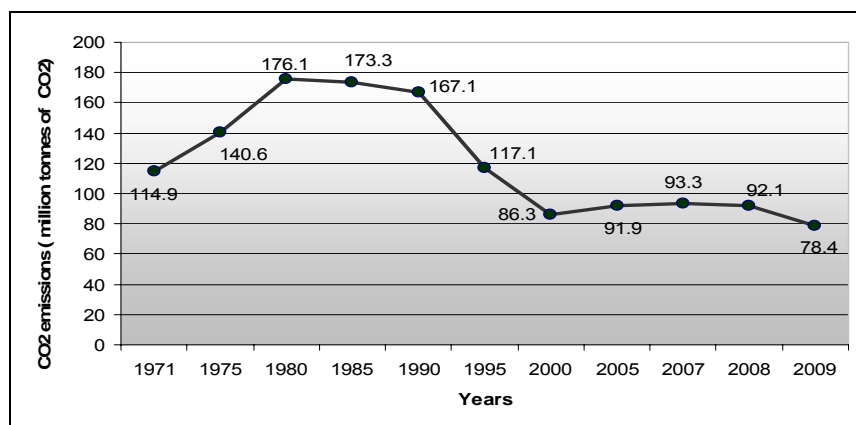
This protocol includes absolute commitments of emissions reduction for 38 industrialized countries, with a 5.2% overall reduction in carbon dioxide emissions until 2012, compared to the corresponding emissions in 1990. Romania signed the Kyoto Protocol in 1999, and the value of commitment of gas emission reduction in greenhouse effect assumed for the period 2008 - 2012 is 8%, considering the level of emissions in 1989 as the reference level.

The United Nations Convention on Climate Change (UNFCCC) was signed in Rio de Janeiro on 5th June 1992 and in the same year Romania signed this Convention, engaging to act for the stabilization of greenhouse gases concentrations in the atmosphere at a level that would prevent anthropogenic disturbance in the climate system.

Since 2002, Romania sent annually to the UNFCCC Secretariat the National Inventory of Greenhouse Gas Emissions made according to IPCC methodology, using the common reporting format for all countries (CRF Reporter). According to internationally assumed obligations, Romania submitted in 2010 the national inventory, which contains estimates of greenhouse gas emissions for the period 1989-2008. Total emissions of greenhouse gas fell in 2008 by 46.89% compared to emissions in 1989.

The historical situation analysis of the CO₂ evolution in our country can be based on the following chart:

Figure 2. CO₂ emissions in Romania



Source: drawn by the authors based on data from the International Energy Agency, IEA Statistics - CO₂ Emissions from Fuel Combustion. Highlights, 2011 Edition, at www.iea.org/co2highlights.

Looking at the figure above we can say that the numbers for Romania show a reduction in carbon emissions by 53.1% in 2009 compared to the value recorded in 1990. This downward trend did not occur only in our country but also around world, as shown in a study made for the year 2009 by *Nature Geoscience Journal*, which shows that atmospheric CO₂ emissions have dropped significantly due to the recession.

In Romania it was easy to reduce these emissions should by half compared to the level of 1989, because the industry disappeared and not because the economy was free of carbon emissions. Restarting the economy might change the situation. we can disconnect the economy from carbon because Romania has a great potential of wind energy in Dobrogea, hydropower and geothermal energy potential, namely a set of resources.

Along with increasing global mean temperature the frequency and the intensity of extreme events may increase: temperature waves, extreme temperatures, reducing the surfaces, and increasing mean level of the sea, the effects of climate change will be felt in agriculture, forestry, transport, population health especially through the spread of disease.

Consequences of global warming. Case Study: Romania

As a result of the geographical position of our country in the European context, Romania has a temperate-continental climate specific to Central Europe, with four distinct seasons, where local climatic differences are determined mainly by relief and latitude and less by ocean influences from the West, by the Mediterranean influences from southwest and by the continental influences from the east. In terms of heat, annual average temperatures are 11° C in the south, while in the north they reach 8° C.

Global warming caused climate changes in Romania and although we still have four seasons, they are no longer the same because temperatures increased, more periods of hot weather being recorded in the south of the country. So, during the last years, extreme events have occurred, the weather went crazy, so that from year to year, when it should be hot it is cold, when it must snow there is sun, sometimes it rains for weeks, sometimes drought cracks the land. Snows of the past no longer exist and the rains turn into storms and cloudburst.

Heat waves - a consequence of global warming - involve some risks to health, especially in urban areas, where temperatures are higher. It is known that hot weather may increase the risk of death, especially to people susceptible of sensitivity to the effects of heat stress. Highly vulnerable are, in general, people

of ages exceeding 65 years. The number of people suffering from lung disease, especially children and old people, is continuously increasing. And so the frequency of skin cancer. The reason is the damaged ozone layer, which no longer retains harmful ultraviolet radiations.

Global warming leads to the intensification of allergies and diseases that occur in the spring. Thus, it was found that in the last decades, the number of people suffering from spring allergies and asthma increased significantly. Scientists justify that growth by the fact that high levels of carbon dioxide in the air and increasing temperatures hasten the flowering of some plants. In this way, the periods when the pollen is produced and implicitly when allergies generated by it are longer.

Relative air humidity recorded annual averages ranging between 73 and 78% in the last five years, being steadily falling in summer (67-70%). The high air humidity is related to the appearance of fog, 40-50 annual cases occurring at a greater frequency in the lakes and rivers. The most frequent fog phenomena can be found in the interval from October to March (96.2%, with maximum in December).

Global warming may cause landslides, thus affecting the construction of houses, the water treatment installations, the water pipes, the roads, the railways and even the water courses. Vegetation is even more necessary, vigorous roots being a network support of the soil. Romanians must get used to construct well-established housing on deep foundations, with roof well anchored and to return to the old orchards near the house.

Catastrophic floods in our country (especially those recorded in 2005, 2006) that caused dozens of deaths and destroyed thousands of houses are another effect of global warming and deforestation because the great floods in Romania corresponded to areas heavily deforested.

Extreme events such as floods and drought have intensified in recent years, leading to an increase in river flows in the months of spring and a more pronounced decrease in summer. The massive deforestation in recent years led to the deterioration of the ozone layer. If there are not forests, it is not enough oxygen and not enough rain. The flood disaster of 2005 in the Districts of Neamt, Bacau and Vrancea was amplified by the unconscious cutting of forests from full massifs.

Floods are natural phenomena and a component of the Earth's natural hydrological cycle. Floods and especially the great floods are some of the natural phenomena that marked and deeply mark the development of human society,

being from geographical point of view the most common disasters and also the largest producer of damages and human victims. At the same time, floods have been the triggering factor and the catalyst of great changes in how to approach this phenomenon, from the acceptance of floods as a freak of nature, the human attempt to resist nature through approaches such as fighting floods, defending against floods and up to preventing flooding.

European Environment Agency researchers found that if the process of global warming is not reduced, the sea level could rise by 3 to 5 meters compared to the current level. The Danube Delta could be totally flooded and the entire course of the Lower Danube will be affected. The banks will suffer, especially those embanked, and the big urban agglomerations in the area, such as Tulcea, Galati and Braila, would be partially flooded. Simulations show that the southern area of the Prut, the Siret and the Big Island of Braila could be flooded. The Black Sea coast between Sulina and Vama Veche is also in danger.

World practice has shown that the appearance of floods cannot be avoided, but they can be managed and their effects can be reduced through a systematic process that could lead to a series of measures and actions designed to help the reduction in the risk associated with these phenomena. The management of floods is facilitated by the fact that they are predictable and often it is possible to make a prior warning and usually it is possible to specify who and what is affected by the floods.

Flood risk management means the application of policies, procedures and practices aiming to identify risk analysis and evaluation, treatment, monitoring and reassessment of risk to reduce floods so that human communities and all citizens can live, work and satisfy the needs and aspirations in a sustainable physical and social environment.

Damage reduction and losses of human lives as a result of the floods does not depend only on response actions undertaken during flood, which are sometimes addressed separately, as management of emergency situations. Diminishing flood consequences is the result of extensive combinations of measures and actions preceding the phenomenon, those related to management during flooding and those taken after flooding (for reconstruction and lessons learned from such phenomenon). Thus, a more complete notion of floods management is used worldwide, which includes both the flood risk management and the management of emergencies caused by floods.

Drought and desertification are a big problem because, as in recent decades gradual warming of the atmosphere caused a serious imbalance in our country

and at the global level. The increase in temperature was correlated with drastic decrease in rainfalls and the appearance of excessive drought. The length of this phenomenon led to the desertification of large areas. The deficit in ground water has increased from one year to another since 1984, causing systematic decrease of agricultural production, especially after demaging of large parts of the irrigated area.

In 2007, Romania was marked by an extreme drought considered the most powerful in the last 60 years. Drought recorded in recent years has caused in an important measure macroeconomic imbalances, Romania being strongly dependent on food imports, over 70% of required amount, which has negative effects on the external balance, but also on the evolution of inflation.

In terms of climatology, Romania, and especially the south of the country is increasingly vulnerable to desertification. Climatically, the conditions exist, but the desertification depends on other factors such as the nature of the soil or the human intervention. Climate changes, abusive deforestation and wrong methods of exploiting the crops accelerate the desertification phenomenon. The most affected areas where are the western part of Oltenia and the south-east of Banat. Because of the massive cutting of forests, the Dolj County is facing desertification of the soil. Although, for the time being it is not known exactly how much of the surface is affected by this phenomenon, because there is no statistics in this respect, it is estimated that 4% -5% of the county soil is now desert, and the phenomenon continues.

The presence of sandy soils, unable to retain water, determine the character of semi-arid area - at least in the south of Dolj – increasingly lowering the level of groundwater and even desertification (disappearance of vegetation). Studies have shown that in the Oltenia Plain, the frequency of years with low and very low yields, as a result of droughts, is between 36% and 39%.

Trends and recommendations for global warming management

Specialists claim that temperature is clearly increasing, but differently, namely will be areas where intensity will be higher depending on the season. Thus, in extra-Carpathian area and in northeast of Romania there is a higher probability of having an increase of temperature in winter compared to that area.

In summer, the probability of having higher increases in thermal values will be in the south and southeast. According to the National Meteorological Administration, the climate change in Romania until 2030 is expected to increase monthly average temperature in November and December and during the warm

season (May-September) somewhat higher values being in the mountains, in the south and the west.

For 22nd century Romania, researchers see a warming of 2 Celsius degrees in winter and 3.5 to 4.3 degrees in summer. As regard the rainfall section, information is vague: in winter there will be minor changes and summers will become drier. The Romanian researchers believe that in Dobrogea the increased tendency to drought will lead to desertification.

The European Environment Agency made a simulation showing how our country will be affected if climate change continues. The news is not good: if the effects of global warming will not slow down, Romania will face desertification, land under water problems, extreme weather and the disappearance of plant and animal species. Romanian specialists in environmental show the possibility that, in less than 25 years, Romania will radically change appearance, being affected in each year by drought, floods and tornadoes.

The warning confirms that the Sahara Desert will exceed until 2030 the area currently occupied and will advance systematically to the north, reaching the shores of the Mediterranean Sea, the desert will cross the Sicily, then in southern Italy (Calabria), Herzegovina, Bosnia and will enter Romania, covering the territories in the South (Oltenia, Bărăgan, Dobrogea and the southern part of Moldova).

The time when approximately 3 million hectares of arid lands, exposed to drought, will turn into "Romanian Sahara" is not far. In these areas, rivers with low flows will dry up, soils will degrade into sand blasted by winds, rainfalls will be totally uncontrolled and, through the adverse actions of massive deforestation, there will be more frequent landslides taking away houses and entire villages.

To prevent the devastating effects of global warming it is recommended:

- ✓ reducing emissions of CO₂, methane and other polluting gases;
- ✓ decreasing energy consumption based on fossil fuels and adopting conventional forms of energy (sun, wind, water, biomass, underground heat);
- ✓ replanting destroyed forests and protecting existing ones by creating national parks, protected by law;
- ✓ reducing paper consumption and recycling cellulosic waste to reduce quantities of wood resulted by cutting forests;

- ✓ recovering facilities for the irrigation of agricultural crops as major steps in the feeding the population;
- ✓ regulating watercourses by the damming and desilting works of sewerage networks that take pluvial and accidental spills.

Despite all efforts to reduce emissions of greenhouse gas, the global temperature will continue to rise, requiring at the same time, urgent measures of adaptation to climate change. Through the Strategy and Action Plan on Climate Change of Romania in 2005-2007 aim to take a number of important steps for limiting the emissions of greenhouse gas and adapting to climate change and increasing the awareness in this area.

Romania's post-2012 obligations to reduce the emissions of greenhouse gas comply with EU policy objectives, namely:

- 20% reduction in emissions of greenhouse gas in the EU by 2020 compared to 1990 levels;
- increasing by 20% the share of renewable energy in total energy consumption at the same time;
- increasing energy efficiency by 20% and a minimum consumption of 10% of total biofuel consumption in transport.

In the context of the objective to reduce greenhouse gas emissions by 20%, to promote the use of renewable energy is an area of major importance in the legislative package on climate change and renewable energy. Since emissions of greenhouse gas in the near time horizon does not imply a global warming mitigation, the adaptation to climate change should be an important element of national policy. Adaptation is a complex process, taking into account the variability of effects from one region to another, depending on the exposure, the physical vulnerability, the degree of socio-economic development, the natural and human resilience and the disaster surveillance mechanisms.

Increasing adaptability of Romania's current and potential effects of climate change can be achieved by:

- monitoring the impact of climate change and associated socio-economic vulnerability;
- integration of the measures of adaptation to climate change in sectoral development strategies and policies and their intersectoral harmonization;
- identification of the specific measures for critical sectors' adaptation in terms of vulnerability to climate change.

This requires the identification, based on the existing economic resources, of the necessary measures in order to limit the negative effects predicted by climate scenarios, estimated on a medium and long timeframe (decades). The identified measures will be implemented by collaboration with local authorities and by appropriate technical assistance.

Taking into account the important role of the central and local authorities to identify and implement adaptation measures at national and local level, it is necessary to increase the level of awareness of the authorities and the public.

For 2030, Romania's main objectives are: alignment to the EU average performance as regards the indicators of climate change; commitments for reducing emissions of greenhouse gas in accordance with international agreements and the implementation of measures of adaptation to climate change.

The European Union will implement the plan to combat global warming in 2013. The plan aims at EU greenhouse gas reduction by 20% until 2020 and increase in renewable energy to 20% of the European consumption and energy savings of 20%. A global agreement with the most polluting countries like the U.S., China and India, would increase the effort to reduce emissions to 30%. The biggest economic powers, including the U.S. and China, have already recognized that, on medium and long term, economies should focus on green technologies to remain competitive. In this respect, China has already set ambitious targets for eco-friendly energy production and exploitation, while the United States invest more than 150 billion dollars in networks for alternative energy extension.

Drought, heat waves, heavy rains in short intervals, quick floods, strong storms and seasons different than we used to have, in other words, these are the effects of climate changes that we feel in Romania. So, global warming produces climate changes, modification of the sea level, geomorphological changes, changes in agriculture, more heavy rain in a much shorter time and on a much smaller area, causing problems such as quick floods, but also periods of more intense droughts, more frequent heat waves, etc.

Governments can play a major role in motivating the private sector to invest in innovative technologies, offering clear, predictable, sustainable and consistent incentives.

Conclusions

Nowadays we witness an increase in the greenhouse effect. At the global level, intensifying greenhouse effect results in the heating of the atmosphere and the

earth surface. These cause, in turn, climate change, glacier melting and raising level of sea water, acid rains, changing rainfall regime, increasing soil temperatures resulting in dryness, etc. Against global warming there is a sustained struggle the central aspect of which is the ratification of the Kyoto Protocol by governments for reducing emissions of pollutants that affect the speed of global warming.

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