

GLOBAL WARMING, ITS CONSEQUENCES IN THE ENVIRONMENT AND IN SOCIAL-ECONOMIC DEVELOPMENT IN THE ADRIATIC COAST OF OUR COUNTRY

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Abstract

The climatic changes are not a new phenomenon. Science has been able to prove that during the long geological history of the Earth, such phenomena have been occasional. According to their duration, they are called Era, period, Ice Age or Inter Ice Age.

The current climate changes have been noticed by the scientists since the period of industrialization began by using fossil fuels and they have predicted that this phenomenon will be worse, with negative consequences for the development of life on the Earth.

Nowadays, these predictions have been proved and it is observed that the growth rate of "global warming" is higher than it was expected.

The studies of this problem have proved that the present global warming of the Earth is a consequence of the growth of the "greenhouse gases" amount in the atmosphere and this change is caused by human activity.

The most known scientific study centers in the world and the specialized institutions have drawn the attention of the public opinion and of the governments in many countries in order to react and adopt the measures of this phenomenon that will have negative consequences in the development of the life on the Earth.

This phenomenon will have effects in all the world, but more exposed will be the low coastal areas, which will not only be damaged by the phenomenon of global warming, but they will also have indirect consequences as a result of the increase of sea and ocean level.

Our Adriatic coast, as a low coastal area will have serious consequences in the environment and in the economic and social development, such as:

The partial or complete flooding of the coastal eco-systems by damaging the biodiversity of the whole area and causing great damage for the natives.

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The flooding of these areas will have serious effects of the people not only on home, economical activities, beaches, but also on soil erosion from salt, the damage of water assets especially of those underground resources and will have consequences in people's health etc. The damage is also predicted in these areas from sea storms, high tides that could be more frequent as a result of the global warming. It is also possible that houses, farmers and their wealth, animal farming, fruit trees will be damaged as a result of flooding caused by the rise of river level.

Our country as a participant in many international agreements has the obligation to take the right measures to implement these agreements within its possibilities in order to face the global warming.

Key words: climatic changes, global warming, Ice Age, Inter Ice Age, greenhouse gases, poleoclimatology, environment, biodiversity, KiotoProcolect.

The method used :

The study of the specific materials

The study of the press materials

The study of the materials taken from the internet.

Field observation

1. "Climatic changes" and the factors affecting this phenomenon

According to climatology and meteorology experts and scholars the term "climate" means the entirety of average atmospheric conditions such as: temperature, atmospheric pressure, wind, humidity etc. Identified from the study of data over a period of time, at least 30 years that characterizes a particular geographical region. Climate is a result of solar energy, which is the engine of all climatic process, with atmosphere, ocean surface, Earth's crust, glaciers, vegetal land cover and the Earth's surface affected by human activity.

With the change of these elements, climate also changes, but "climatic changes" are not the same with "global warming", because its substance also includes the cold phases of global warming. "Global warming", that nowadays is often used to explain "climatic changes", is actually only a part of climatic changes that consists in temperature increase, in planetary scale and nowadays is viewed precisely this phenomenon.

Scholars and various specialists of Paleoclimate explain that the Earth in its geological history has gone through different climatic phases like different Eras, periods and moments of climate warming and coldness that lasted from several millions to several hundreds or thousand of years.

According to Paleoclimatology science, the climate changes over the impact of various factors that can be classified into external or internal factors such as solar activity, orbital changes of the Earth, the impact of the collision of meteors and factors arising within or around the Earth as changes of the continent's structure by tectonic plate movement theory, ocean currents and atmosphere composition. The studies carried out by scientists have concluded that the global warming is largely the result of atmospheric changes.

The atmosphere layer, that serves as a cover for the entire globe, plays a crucial and irreplaceable role in maintaining the temperature of Earth. Saving the average temperature of Earth at around 15 degrees Celsius only due to the "greenhouse effect" of several gases that make up the Earth's atmosphere. To play this positive and irreplaceable role, the amount of "greenhouse gases" of the atmosphere have to preserve a certain balance, disruption of which can lead to the reduction or increase of air temperature and consequently to climate changes.

The main component gases of the Earth's atmosphere, that have the greatest 'greenhouse' impact are: carbon dioxide, ozone, methane, water vapor etc, which don't make up more than 1% of the atmosphere, have the crucial role of "greenhouse effect". These gases are generally heavy and stay near the surface of Earth. They absorb and conserve the warmth of sunlight reflected by the Earth, influencing in maintaining the temperature of Earth in necessary parameters for life development, but the change of their amount, leads to changing the warmth of Earth.

2. Recent causes of climate change

Recent warming of the Earth as a phenomenon is observed about 150 years ago, period of time that coincides with the moment when the development of industry started using fuels. Scientists have followed closely the changes in the composition of the atmosphere as a result of

the use of fuels for the needs of the industry and they have early predicted the negative consequences. Science started to think seriously about the problems that were arising especially from the second half of the XIX century. The climate change was held in a continuous monitoring, concluding that global warming was mainly the result of disbalance among the gases that make up the atmosphere. It was noticed an increase in considerable amount of greenhouse gases as carbon bauxite, methane etc. The analysis of the phenomenon conclude that the increasing presence of greenhouse gases in the atmosphere is not the result of a natural phenomena, but a result of human activity. Prof. M.Messerotti says about the currently climatic change: "In the last 150 years it was recorded a progressive increase in temperature which is thought to be caused by the human activity"².

As well, the IPCC report of 2007, emphasizes that: "Since 10,000 years up to 1750 the amount of CO₂ in the atmosphere reached 265 ppm, while in the last 150 years till 2006 the amount of carbon bauxite reached 385 ppm in the atmosphere. The increase of greenhouse gases since 1750 was mainly due to the use of fossil fuels, from agricultural activity and changes in the use of the territory"³.

The same is confirmed by other researchers and specialists in the field of meteorology and climatology such as the professor Ettore Ruberti, scientific researcher in ENEA, Italy in the Scientific Rubric "Museo Energia"who says: "From the beginning of the industrial era to today, the concentration of carbon dioxide in the atmosphere has risen from 280 ppm to 400 ppm, and methane, for the same period has increased about 150%"⁴.

In the recent dates of Nasa, GIS (Goddard Institute for Space Studies)of New York is noted: "August 2016 was the warmest August in 136 years of modern record-keeping, according to a monthly analysis of global temperatures"⁵.

²Interview with journalist Rocco Belantone in University of Trieste

³IPCC, *Fourth Assessment Report*, 2007

⁴Ettore Ruberti, *Cambiamenti climatici ed eventi estremi*

⁵Giss. Nasa.Gov.

Given the serious negative consequences that this phenomenon presented, this problem became a continuous object of discussion in the scientific institutions and international organizations.

A crucial role in this regard has played the body established within the UNO in 1988, the IPCC in which are currently working over 2500 scientists from 130 countries. The main object of the activity of this new body is monitoring the phenomenon of global warming and propose measures to overcome the negative effects of this phenomenon on a global scale. IPCC had made regular reports on climate change, but we will mention two of them, that of 2001, in which it is emphasized: "It is increasingly evident that the majority of global warming in the last 50 years is attributed to human activity " and in the report of 2007 is emphasized: "Temperature increase in the last 50 years is attributed to the increased presence of greenhouse gases in the atmosphere".

Among numerous international activities in the framework of the UNO, one of the most important remains the Protocol of Kyoto, held on December 11, 1997, attended by more than 180 countries. In this meeting, important decisions have been made on limiting greenhouse gases emissions in the atmosphere, mainly by developed countries that are the greatest polluters of the atmosphere.

The effects of temperature increase in planetary scale will be felt in all aspects of our daily lives, but I will focus in some directions that I think have a greater impact on the environment and socio-economic development in our country's Adriatic coast.

3. The consequences of "global warming" in the seas, oceans and coastal low areas

3.1 The increase of water level of the seas and oceans:

In the last 100 years the overall level of water of the seas and oceans has increased at 10 to 20 cm, with an average of 1-2 mm/year, with a rate about 10 times higher than the average of

the last 3000 years. This is the direct result of increased air temperature of about 0.2-0.6 degrees Celsius from 1860 to today⁶.

Predictions of scientists and scientific institutions say that within the year 2100 the level of the seas and oceans will rise from 9 to 88 cm⁷. This increase in water levels will be due to two factors:

- the water volume increase of the seas and oceans due to heat
- the injection of additional water obtained by melting of polar ice caps, glaciers and mountain glaciers.

Such a situation would create major economic, social and environmental problems internationally and particularly in our country.

Nowadays almost all research centers of Meteorology and climatology, including even IPCC, agree on the fact that by 2100 the level of the seas and oceans will grow from 9cm to 88 cm due to global warming, and this would have very serious consequences on the low coastal areas. Such a situation would create problems, just like in many other lowland coastal areas around the globe, especially serious problems in our Adriatic coast, which is low in some areas, such as Lezha coast, situated below the sea level. In these areas, especially after 1990s, a large number of population is located, population that have come from the interior areas, and have organized their lives with buildings and activities. The raising sea levels will create major economic, social and environmental problems.

The risk of erosion and flooding from sea waves in these areas will be even greater given the fact that currently nearly our entire Adriatic coastline is under pressure from sea erosion due to unexperienced utilisation of the river beds from human activity which has led to the reduction of the solid flow of rivers in the estuary.

⁶Luiza Arezzo, *Legambiente*, Roma, Italy

⁷Luiza Arezzo, *Legambiente*, Roma, Italy

3.1.1 The consequences of water level increase of the Adriatic Sea on the coastal environment of our country.

Our Adriatic coast has a length of 273 km, 55 km of which are semi-high type and the rest is a low coast, cumulative type, rich in beaches, wetland ecosystems of all kinds and with very rich biodiversity, with river estuaries, coastal forests, lagoons etc. During the extended political transition, this coast rich in a variety of ecosystems was severely damaged both by human activities and by erosive activity of sea waves. The German environmental association "R. Schwartz" and Albanian association "Eco Movement" in a common activity on December 28, 2010 concluded that

in Kune Vain wetland system in Lezha, there are dramatic damages related to human activity, as well as to global warming. The same can be said about the other areas of our Adriatic coast.

According to professor A. Frashëri, on the Adriatic coast there are areas that are in tectonic decrease, such as Seman segment ,to the left of the river estuary, in Patok beach and in Lezha coast⁸. In these segments even nowadays there is a strong marine erosion, but if we add the sea level rise as well as other phenomenon as undulation, marine storms that can be present in the future due to global warming, the consequences can be really serious.

3.1.2 The effects of sea level rise on wetland ecosystems

Natural ecosystems contain all the terrestrial wealth of genetic biodiversity and species and make the primary fund of life on earth.

Ecosystems in environmental processes play a fundamental role in the carbon cycle, recycle waste, clean water, control flood, land degradation phenomena and processes of erosion. At the same time ecosystems make up a major economic asset for the population.

⁸Frashëri Alfred, "Geophysics and environmental engineering", 2012.

Our entire Adriatic coast is very rich in wetland ecosystems. From Viliunit lagoon in the north to Orikum lagoon there are six wetland ecosystems in a total area of about 115 km², but if all their wetland surroundings are included, the surface of our coastal ecosystems is larger.

In our northern border lies one of the most beautiful wetland complexes that includes Buna River estuary with beautiful islands of Franz Joseph and Ada, the bank of Buna river up to the Lake of Shkodra, Velipoja reserve, Viluni marshes.etc which is an area with a very rich biodiversity and not only with a great economic interest, but also environmental, touristic etc. Only in the Lake of Shkodra live about 70% of bird species that live in our country's ecosystems.

Currently it is one of the areas most affected by natural phenomena due to flooding, but the tendency of rising sea level, the increase of flow marine storms, the increase of flow water from Buna and Drin rivers because of global warming, can make this, one of the most endangered ecosystems of our coastline.

Another very important complex and beautiful ecosystem of our coast is from the mouth of the river Drin, marshes of Kune-Vain-island Lezhe, beaches Shëngjin-Tale. This is one of many ecosystems with rich biodiversity. This area with an extraordinary economic and environmental importance is seriously endangered due to global warming and sea level rise. This is a low coastal area that in some sectors is below sea level and rising sea water level, the increase of flow marine storms, water tides, but also because it is a decrease tectonic area, is considered as an area with a high risk of flooding in the future.

Going down in the South between the mouth of the rivers Mat and Ishëm is located the wetland complex of Patok, one of the most interesting attractions of the Adriatic coast. In this complex the lagoon of Patok is located, the 200 ha forest and about 450 ha agriculture land, whereas in the South the Patoc beach is located. It is important to highlight that this area is very rich with underground waters that serve to meet the civil needs of the population. Today the beach of Patok is almost completely flooded becoming a marsh and the expectations about the future are even more pessimistic, because among other things, it is thought that it is a decrease tectonic area.

The ecosystem of Rrushkull in Lalzi Gulf, between Rodon Cape and Tail of Palla is in the South. This area is in the process of corrosion due to the damage of Erzen river bed.

The wetland complex of Karavasta, that includes the lagoon of Kavarasta, the Pine of Divjaka, sandy belt and agriculture lands is especially important for the economy of the country as well as for the environmental values as an ecosystem extremely rich in biodiversity. In this wetland complex the rivers mouth of Seman and Shkumbin are included, two areas with very rich biodiversity. So there are two other ecosystems in the lagoons of Narta and in the river mouth of Vjosa as well as in the lagoon of Orikum in the Gulf of Vlora.

Besides wetland ecosystems, our Adriatic coastline is rich with numerous beaches such as the beach of Velipoje, Shëngjini, Durrës, Kavajë, Seman, Vlora. etc.

All this coastal area that includes wetland ecosystems, beaches and numerous residential centers where is located a considerable part of the population with their own economic activities, are under threat of flooding from the sea waves. It is expected to happen because these areas are generally lower that start from below the sea level and go to the heights of one or several meters. Taking into consideration that the sea level rise to 2100s can take up to 80-90 cm as well as the coast in general and estuaries in particular will be under pressure of marine storms and tides, flood damage is thought to be greater.

4. The consequences of global warming on water resources

The water resources include surface waters like lakes, rivers, streams, springs and groundwater reserves. The water resources are one of the most important resources of land without which there would be no life. Albania is thought to be one of the richest countries in water resources. In Albania there are approximately 247 natural lakes of different types and sizes and over 152 rivers, eight of which are large rivers and traverse the Adriatic coastal areas. Also, the coastal area is very rich in groundwater, especially the area of Fushkuqe located in the space between the coast of Lezha and Durres.

The water resources depend largely on the amount, intensity and distribution of rainfall. Snowfall and layers of ice are one of the most important sources of water resources, but now due to global warming the amount of snowfall to us is diminishing and is expected to shrink further. Also cold winter days are being reduced and there are not considerable layers of ice in winter as water reserves. On the other hand, in terms of climate warming extreme phenomena are expected to increase, so with long drought and an increase of the flow of rain and downpours. Both these phenomena are harmful because the first brings drought and consequently a reduction of the water of lakes, rivers and groundwater, whereas the second phenomenon will increase erosion and flooding in the lower river flows. In the recent years, this phenomenon has been observed frequently. It has led to the flooding of the Buna river in Shkodra during 2010-'11-'12, as well as in the decrease of Vjosa in the winters of 2014-'15. These floods caused considerable damage in the agricultural economy of farmers, in livestock and dwellings. The temperature increase in the future is expected to worsen the situation especially in terms of reducing water for irrigation for hydropower needs, but also for the needs of the population, while it is also expected the deterioration of the flooding situation during the periods of rainfall in autumn and spring.

5. The impact of global warming on economic and social development of coastal areas

All the consequences of "global warming" have an impact directly or indirectly on economic and social development of the country. Our coastal areas are the most vulnerable to these impacts not only because they are under the direct influence of climate change, but also of the impact of the sea. The increase of the water level of the sea under the effect of the temperature increase will bring the increase sea erosion and the penetration of sea water in the land which will lead to the loss of all land surfaces and will bring extensive damages in several directions:

- The biodiversity of coastal ecosystems with wetland complex will be spoilt and this would bring severe negative consequences for the economy of the population in these

areas. Particularly noticeable damages will have the area of Lezha in the mouth of the Drin because it is below sea level, the mouth of the Buna river due to sea storm, the coastal areas of Seman because it is considered to be a tectonic area.

- Partial or full flood and the damage of sandy belt of the beaches. In this way a part of the beaches either be demolished or will be shifted further inland. Due to these, noticeable damages would have Tale and Shengjin Beaches in Lezha, Velipoja Beach, Durres Beach and Seman and Vlora Beaches.
- The penetration of sea water in the landwill lead to salinisation of soils and consequently in their desertion. It may also begin the process of a swamp with salty waters.
- The damage of residential and business centers that are often built up near the coastline such as on the coast of Shëngjin Tale, in Seman, in Durres Beach etc.as well as in areas that are in danger of flood, close to river beds.
- The increase of the temperature will directly affect the development of agriculture and agricultural production. Apart from the damages that agriculture may have due to the penetration of salt water in the agricultural lands and their desertion, damages are expected even from extreme phenomena of weather under the influence of global warming such as: long and hot droughts, torrential rains and floods that may come from the river water flows. Prolonged drought accompanied by high temperatures damage plants and reduce the productivity of plants, whereas the numerous river water flows in their lower leakage cause flooding in planted areas, in livestock complexes, on residential areas, etc. as it has happened in the recent years in the area of Shkodra from Buna river flows and in the area of Fier from Vjosa river flows. Over 15,000 inhabitants have been hit by floods of the Buna River with considerable damage to housing, agricultural economies, livestock, trees etc, only during the rains of January and December 2010 in the field of Shkodra⁹.
- The Temperature increase is expected to have its influence also on fruit trees. The World Bank predicted that Albanian agriculture might have a reduced production of grapes and

⁹Report of the "Konrad Adenauer" Foundation-2011

olives to the extent of 20%, but there may be other fruit trees that would be difficult to adapt to the climate change. This can lead to the displacement of their cultivation in other areas further inland by replacing them gradually with subtropical vegetation.

- The temperature can bring very serious consequences even in the health of population. Research centers and specialized international and national health institutions share the same thought that global warming may have direct and indirect effects on public health. Sea erosion and expansion of sea water on the soil surface will bring the risks of coastal areas contamination within sects, viruses, bacteria, but also with dead sea animals that may be carriers of diseases and could provoke very dangerous epidemics.

In particular, it is predicted a growth and spread of infectious diseases such as malaria, tenia, yellow fever, viral encephalitis etc. transmitted by various insects like mosquitoes, etc. This is due to geographical distribution and better conditions created for these organisms. All bad natural phenomena that are manifested as a result of increased temperature as droughts, fires, floods, storms and other weather phenomena, will increase the cases of allergies, dermatitis, asthma, cardiovascular diseases, respiratory diseases, etc. It is believed that a special category of the population such as the elderly, children and persons that suffer from chronic diseases will be more vulnerable.

6. Measures that can be taken to reduce the causes that lead to global warming

Climate research study centers and specialized international and national institutions point out the the risk of global warming is current and is approaching faster than it is predicted and will have catastrophic consequences for humanity, if we do not take drastic measures to stop the causes that lead to it firstly to reduce the emission of greenhouse gases in the atmosphere. Even in our country, the Ministry of Environment has drafted plans for this problem, but I think that all our work in this direction should focus firstly on implementing the suggestions of the IPCC report of 2007, which points out: "Changing lifestyles and modality of behavior can contribute to the mitigation of climate changes"

For this should:

I. Decrease the consumption of fossil fuels origin as oil, gas, coal:

- In the production of electricity should be used renewable energy sources
- Strengthen urban and interurban public transport limiting as much as possible the use of the vehicles.
- In the urban and interurban public transport priority should be given to the means moving on the iron road such as as electric trains, tram etc and not those with tires.
- Give priority to water transport where it is possible.
- Gradually remove from the use vehicles that have long use.
- Consider the gradual introduction of bio fuels market.

II. Rational use of energy:

- Remove the use of electrical equipment with high power consumption and gradually the market consider the introduction of devices with low power consumption and the use of efficient electricity bulbs.
- To draft laws which clearly define the degree of thermal insulation for new constructions to reduce energy consumption for heating and cooling of housing, offices, bars, etc.

III. Gradually move towards the use of renewable energy:

- The use of wind power
- Start making use of solar cells and gradually photovoltaic ones.
- Think about making use of power plants operating with biomass
- Think about expanding the use of small hydropower, where it is possible.

IV. Take organizational measures to improve the movement of vehicles on the road, adjusting the junctions, construction of the underpass, extension of roads etc.

- V. *Develop a national plan to end the problem of collection, processing and recycling of waste.*

The sources used:

1. Arezzo Luiza, Istituto di Ricerca, (Research Institute) presso Legambiente, Rome Italy.
2. Baldaci Antonio, L'Albania (Albania).
3. Boci Spiro, Topographic survey of the coastline from Vjosa in Buna.
4. Boçi Spiro, Different interviews in print and visual media.
5. Frashëri Alfred: "Geophysics and environmental engineering" 2012.
6. Kabo Mevlan "Amending lower river flows that traverse the coastal plains during the historic era".
7. Prof. Messeretti Mauro, Scientific researcher at the "Astronomic Observatory of Trieste Cambiamenti climatic".
8. Prof. Ruberti Ettore, Scientific researcher at ENEA Italy "Cambiamenti climatic ed eventi estremi".
9. Earth Science 2010.
10. Perikli Qiriazzi, Physical Geography of Albania.
11. Resolution of the IPCC, 2001.
12. Resolution of the IPCC, 2007.
13. ECNC-European Centre for Nature Conservation "Climate change and biodiversity in South-East Europe".
14. The project of WHO "Protecting health from climate change" (2011-2021).
15. UNDP-Study on "Climate change, impacts and adaptation measures in the Kune-Vain".