

EFFECTS OF GLOBAL WARMING ON BIODIVERSITY

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Abstract

The global warming in recent decades - especially due to anthropogenic activity - already has a negative impact on biodiversity and in the future is expected to become a more significant threat for the future decades. In the present paper are analyzed detrimental consequences of this phenomenon on natural vegetation and fauna but also on the „artificial” vegetation (agricultural crops) on Earth. Thus, higher temperatures coupled with changing rainfall regime, lead to the extinction of species of plants and animals the later migrating into areas where conditions are more or less close to their needs. The paper outline the state of forest fires, the melting of glaciers and glacial ice caps at the poles, affecting aquatic biodiversity. It analyzes the appearance of aridity of more tracts of land areas of the world and in Romania, the lack of water which affects the life of the planet in general as well those of the people by restricting the decrease of arable land and agricultural production.

Key words: biodiversity, fauna, global warming, natural and artificial vegetation, negative impact

Introduction

The global warming in recent decades already has a negative impact on biodiversity and in the future is expected to become a more significant threat for the future decades.

In recent decades there has been a change of climatic factors, an increase in annual temperatures, especially in summer, which extends in duration. This climate change is largely due to anthropogenic activity has a negative influence on the entire natural environment. The last 15 years (after 2000) were the warmest years after 1900, the temperatures rose by 0.9°C.

In this paper we will refer only to the adverse effects on biodiversity products (both natural and "artificial").

Discussions

First, we present aspects of natural vegetation and fauna which is suffering due to temperature rises.

Rising temperatures coupled with changing rainfall leads to the disappearance of some species and their migration (the animal's case) in areas where conditions are more or less close to their needs. In this sense, are eloquent some examples:

In the mountain areas, species of plants and animals accustomed to colder and wetter habitats, migrate upward vertically. Many of them will disappear, the case of pika (*Ochotona princeps*) that live in the western mountains of North America and southwestern Canada, an endangered species included in the IUCIN Red List (Fig. 1, a) (Beever and Smith, 2011; Smith and Weston, 1990). It is accustomed to low temperatures at 2.800 m altitude and now is considered an endangered species. The species dies in 6 hours if is exposed to temperatures above 25.5°C, being an important indicator of this global process (Hafner, 1993).

Another example is the small mountain vertebrate – the marsupial pygmy possum (*Burramys parvus*) living in the cracks mountains of N -E of Victoria and south of New South Wales, Australia, which is also an endangered species. The nocturnal Bogong moths (*Agrotis infusor*) are the vital source of food for pygmy possum when it wake up from hibernation. These moths migrate to the mountains every summer to escape from the heat of the lowlands. They will be forced to compete with other small mammals in the same habitat which is very hard and they are forced to migrate to other areas for other food sources. Here, in this new habitat, they are exposed to the danger of being eaten by cats and foxes and in this way their number decrease (Fig. 1, b) (Groves, 2005).

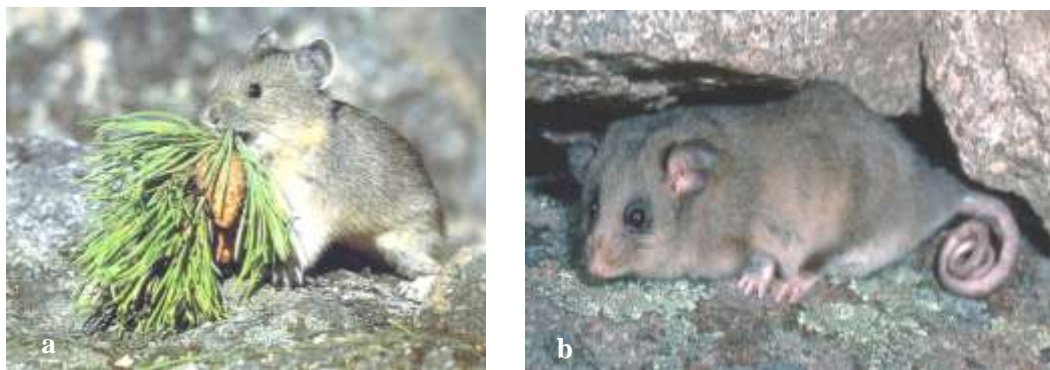


Fig. 1. Two endangered animal species: American pika (*Ochotona princeps*) and pygmy possum (*Burramys parvus*) (Source: Wildscreen Arkive, photo Linda Broome) (b) (a- from Bavaru and Bercu, 2014; b- Web 1).

The savannah areas, containing one of the richest qualitatively and quantitatively biodiversity, will have much to suffer from the increasing temperatures and by the reducing rainfall regime. Millions of animals will have nothing to eat from such an arid field and will disappear.

Another consequence of rising temperatures, especially in the warm season of the year, is the increasing occurrence of numerous fires in forests on Earth. In the US, who frequently face such fires, the researchers showed that an increase in summer temperatures by 1.6°C will double the number of fires, especially in the western of United States zones (California and Texas). Let us not forget that this summer in August in northern California fires have produced a disaster.

Russia, in summer 2010, was faced with very high temperatures, especially at the beginning of August, when the temperatures in Moscow and in European Siberia frequently reached 40°C. As a result there were numerous fires, some even near Moscow, burning forests and whole villages and were threatened two Russian military bases as well. The population of Moscow had to fight the wave of smoke for days, being required to wear protective masks (Bavaru and Bercu, 2014).

Every year warm period occurred in the last decade, both in southern Europe (Spain, Portugal, Italy, Greece etc.) took places a lot of devastating fires and in Australia or America.

In this summer - 2016 - in our country, such as in other countries in the Balkans, they have been numerous fires, both in the Eastern and Southern Carpathians and in Apuseni mountains as well, which destroyed hundreds of hectares of forest, generating a large losses of our country forest fund.

The specialists consider that in the future many wet areas of the world (South America, Central Africa or New Guinea) will become drier areas and species of trees in these forests (even trees species with wood essence of economic value) may disappear. The same will happen with other species of plants and animals.

We recall a single example spent in our country, in the summer of 2007, in Braila (Romania), the County where it hasn't rained for 147 days and summer temperatures have exceeded 30°C, often arriving and at 40°C (in the shade). In the Natural Park "Small Pond of Brăila", dried all trees and in the park began to appear, ruderal herbs characteristic of steppe grasses with no value (Bavaru and Bercu, 2014).



Fig 2. An image that shook the world: a dead polar bear washed ashore (a) (Source: World Supplement in News, January 12, 2016) A polar bear on an ice floe in Spitsbergen. (b); (Source: The Telegraph, June 12, 2015, photo: Rex Features) (a, b- Web 2).

The polar bears (*Ursus maritimus*), which are vulnerable species (Wiig et al., 2013), and the generally zone fauna of the cold areas of the globe), after the gradually melting of the polar ice caps and glaciers in the northern hemisphere, they are shrinking habitats, no longer able to procure food, only with great difficulty, are in danger of extinction (Fig. 2, a, b).

The rising temperatures will affect life – the biodiversity – from the oceans freshwater. A recent study conducted by US National Wildlife Federation (NFW) shows that in the future - in approx. 25-30 years - in the circumstances described above – the waters of rivers and streams that flow into the Pacific NW, they will no longer have trout and salmon, will not be able to organize farmers for these valuable species of fish because the water heating (Fig. 3 a, b). It envisages strong pressure on other cold water fish species in the NW area of the US and Canada.



Fig. 3. Atlantic Somonul (*Salmo salar*) (a) și brown trout păstrăvul (*Salmo trutta*)(b) (a- Web 3; b- Web 4).

Even greater problems are in the Earth waters of the seas and oceans. Biodiversity in these waters has already begun to be affected by a waters warming above normal (Bavaru et al. 2007). Arctic and Antarctica reflects the solar energy and maintain the constant temperature of the Earth. Unfortunately Arctic warmed twice as much as the rest. Especially in spring and summer polar ice caps are melting faster due to rising temperatures. As a result increase the level of seas and oceans (in the last year already increased by 22 cm). In 2100, if it continues this process of global warming, the seas and oceans will rise by 1 m, flooding and destroying numerous islands and towns on the shore (Maldives Marchal, islands and towns as Amsterdm, Rotterdam, New York etc.).

The ocean waters becoming warmer absorb more CO₂ from the atmosphere (also enriched increasingly more CO₂) dissolve it, making the waters more acidic, harmful to corals and other marine species - acidic pH does not favor life in general. Thus, the coral reefs of warm seas - extremely sensitive to environmental changes - began to suffer, becoming white - that is death. Temperature increases in the waters around them have favored the emergence of an epidemic that leads to coral death (disease green stripes, yellow, red) and a disease called "white syphilis" (Fig. 5).

The specialists in marine biology consider today that in the Pacific Ocean, the Great Barrier Reef zone (344 400 km² in area, especially in the Port Douglas - Cape York Lizard Island). In the Indian Ocean as well almost 70 % of their coral reefs have been bleached and died!

These reefs are true marine biodiversity centers of the warm waters of the globe. It is estimated that 65% of marine fish species live and reproduce in this warm waters (Fig. 4). With the death of these reefs they will migrate, leaving an almost dead area. To will this adds the overfishing and other human impacts related (the coastal development and sedimentation processes), the case of Philippines reefs (Burke et al., 2001).

Concernng this subject, Dr. Russel, Reichelt Chairman and Chief Executive of the Great Barrier Reef Marine Park Authority (GBRMPA) said: „Collaborative efforts by a large number of institutions and tourism industry volunteers allow us to say with confidence that while bleaching caused by heat stress affected most of the Reef, the most severe mass bleaching and the greatest mortality has been restricted to north of Port Douglas”.



Fig. 4. A healthy coral on the Great Barrier Reef (photo Debra James/Shutterstock/WWF) (Web 5).

Since the beginning of the industrial revolution, the waters marine acidity increased by about 30% as it deems marine biologists. This acidification, according to the United Nations Environment Programme, makes the reef's skeletons limestone coral forming to be much more difficult.

Instead, in these special environmental conditions, feel good and proliferate, species of jellyfish and other Coelenterata species, worthless and even biological. In the Mediterranean Sea - for example - due to changes in the chemical content of water - populations of jellyfish, most of them poisonous, have developed much exaggerated, this large sea being, nearly suffocated by this poisonous creatures. They arrived this summer in the Black Sea, along the Turkish coast being threatened Bulgaria as well. In addition, the experts warn that this organisms are more poisonous than in the past. In the past three years, thousands of people who come on holiday in Spain arrived at the hospital after being touched by the jellyfishes.

Due to global warming, the Black Sea is becoming more like the Mediterranean Sea which, in its turn, begins to have large tropical characteristics.

The terrible poisonous jellyfish, Portuguese galley (*Physalia physalis*) which can kill a man just by touch, specific to the warm waters washing the Portugal shores (Fig. 6, a), was carried by winds to nearby beaches of Great Britain. Thousands of Portuguese galley invaded the beaches of France. A series of expansive beaches of the Côte d'Azur of France, the Great Barrier Reef of Australia and Waikkal and Virginia, United States areas, were closed because of the threat posed by the jellyfish invasion.

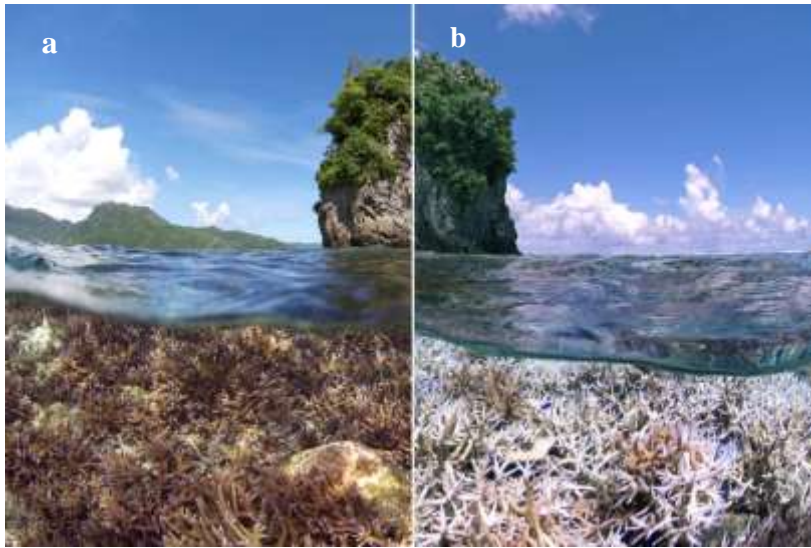


Fig. 5. Before and after image of the bleaching in American Samoa. The first image (a) was taken in December 2014. The second image (b) was taken in February 2015 (Photo: XL Catlin Seaview Survey, Chaisson, 2015) (Web 5).

According to biologist professor Nikolai Marfenin from Moscow State University, because of the unprecedented heat, the freshwater jellyfish *Craspedacusta sowerbyi* (lapsus), it has greatly multiplied, reaching in the Moscow River, which cross through the Russian capital (Fig . 6, b).

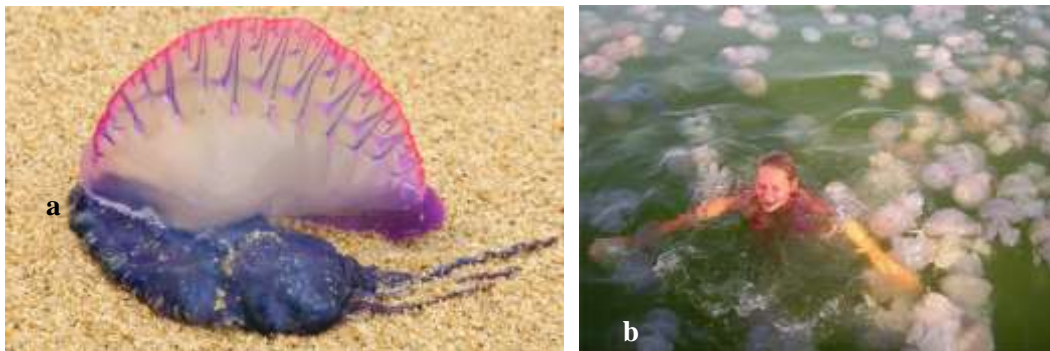


Fig. 6. The terrible poisonous jellyfish, Portuguese galley (*Physalia physalis*) (a). The freshwater jellyfish *Craspedacusta sowerbyi* (b) (a- Web 6; b- from Bavaru and Bercu, 2014).

According to the most recent Intergovernmental Panel on Climate Change (IPCC) report in 2016, the sea level is predicted to rise by 26–98 cm by 2100, due to the thermal expansion of the oceans and the melting of polar ice-caps and ice sheets. The warming of the marine waters coupled with the effects of storm surges, which are expected to be of a greater magnitude in a warmer world and damage lands (Fig. 7, a), this increase in sea level could threaten many coastal ecosystems such as the mangrove ecosystems from S -E Asia (Indonesia, Vietnam, Philippines, etc.) but also those of Australia (Kakadu National Park, the largest terrestrial national park of the Nothen Territory of this continent) (Fig. 7, b). These areas are also preferred habitat of many species of fish and even other marine organisms, especially for reproduction. These ecosystems (mangrove forests) will be swallowed by mangroves and water - if the sea levels will rise (Web 8).

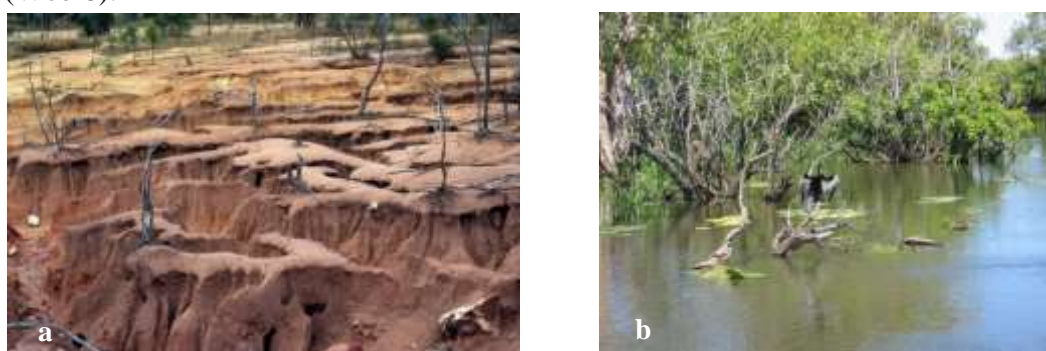


Fig. 7. Changes in rainfall patterns can damage land, plants and animals.

(Image source: Willem van Aken/CSIRO Science Image) (a).

Mangroves and wetlands in Kakadu National Park are some of the areas under threat from rising sea level. Source: NOVA, image: Paul Morrison/Flickr) (a, b- Web 7).

Finally, we mention a study by IUCN, stating that given that climate change will continue in the future, in less than 100 years, a quarter of species of plants and animals on Earth will disappear. Dr. Ahmed Djoghaf, executive secretary of UN Convention on Biological Diversity, said recently that "the erosion of biodiversity is continuing at an unprecedented rate in history, extinction rates of species could be 1000 times higher than those recorded by the natural over time." The vertebrate species populations have already been reduced by about 33% between 1970 – 2006 according to information published by UN.

Many scientists believe that the current extinction of biodiversity is second in size after the first one that took place in late Permian (about 250 million years ago) (Bavaru and Bercu, 2014).

An ongoing project called - "The Economics of Ecosystems and out biodiversity (EEB)" - to quantify the financial value of services that nature brings them to us (air and water purification, wildlife ecotourism, food source, etc.). For example only annual fund forest destruction amounts to 2000-5000 billion dollars - well above the current banking crisis costs (Brown, 2011).

II. Secondly we present some aspects of artificial vegetation effects of global warming of agricultural production, especially grain production.

The specialists in the field say that any temperature increase of one degree above optimum temperatures of crop plants leads to a high 10% decline in grain production. What is the explanation?

First it is affected photosynthesis process. The leaves begin to turn and photosynthesis is suffering. Add to this increase in temperature the lack of the usually water and we will better understand why field crops are threatened. Experiments conducted in USA, Japan, India, Taiwan, etc. on the major world crops (wheat, corn, rice, soybean, etc.) have shown that sometimes yield crops by more than 10 %. For soybeans and corn, American experts have estimated that production decreases by 17%. If temperatures would rise by 2°C what climatologists say it is possible in the future), then wheat production (and others) would be reduced between 37 % and 58 % and these figures remain close even if the crops are irrigated (the experiment was done in India).

It is considered by professionals that plants die if temperatures pass over 40°C in the shade, when photosynthesis stops and the plants wither and die. It is already affected when the temperature passes 35°C in the shade, practically is capped.

Secondly, there is also a reduction of pollination, the plants remain sterile, cannot bear fruit. Reproductive parts of the flower begin to dry. Pollen cannot germinate without having the necessary humidity. Experiences made in US and Philippines showed that the most affected the large crops plants are maize and rice. At 38°C the pollinated plants percent is almost 0 and 40°C throughout the crop is destroyed.

A calculation in the EU - by specialists in agriculture - shows that plant pollination, especially by insect is in an evident decline in Europe, and this would cause damage of 15 billion euros per year. But globally, that would be the case? We can see from the foregoing that this increase in temperature can affect the food security of the world. Until 50-60 years ago, agriculture has undergone few

major climate changes, climate being more or less stable. So the warming process makes us think of the bad and very bad things (Brown, 2012).

But not only large crops are affected by these climate changes and especially the rising temperatures. For example, another case occurred in India in cultures of tea. The tea cultures from the Indian province of Assam produce around 55% of India's tea production and about 1/3 of the world production of tea. In the winter of 2009-2010, the temperatures in the province have not decreased, in the winter season, below 9°C. As a result, the tea leaves remained on branches, they have not fallen. In the recent years, the average temperatures in this province have increased by 2°C and rainfalls decreased by 1/5. April and May are more rainy seasons, favoring the emergence of different pests (especially fungi). These crops are organic (ecologic crops) and cannot be sprayed (the main part of production goes to export, being severely controlled). As a result the production decreases, both quantitatively and qualitatively, modifying especially aroma. In 2010 tea production fell to 460,000 t - the lowest production in recent years. Mridul Hazarika, Director of the Tea Culture Research Association of India, appreciates that all these shortcomings are due to climate change and especially to temperature increases and changes in rainfall regime in the province of Assam.

The most regions of the world affected by temperature increases are the subtropical and tropical, where hunger produces already many damages. In our country as well, the extremely hot summers, with little rainfall in recent years and especially this summer, led to a process of aridity, even desertification in some south areas.

As a result, specialists in agriculture recommends that in the future in these areas to be cultivated varieties of wheat and corn resistant to drought. Moreover, there are few specialists recommended for cultivation of sorghum south, a resistance to drought Poaceae species, rich in proteins and active substances, well above corn's (currently grown in Africa for its qualities).

Conclusions

Understanding the complex interaction between the impact of climate change and how the environment responds to these natural changes is now essential not only for nature conservation, but also for preserving the benefits that nature provides us, as livelihoods. Through the common efforts of all profile organizations, scientists and countries governments but also everyone else's we can to save the nature and us, humans as well.

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