

## The Effects of Global Climate Change on Ecology\*

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### Abstract

Climate fundamental provides limiting opportunities of human activities and ecosystem functioning within global ecology. Climate change could effect on alterations in the frequency and severity of droughts and floods; water supply; air, soil, and water quality; ecosystem health; human health; and resource use and the economy. Climate change may act through multiple pathways; interactions in and impacts on the global ecosystem can be different pathways. Within ecosystem environment, there are already numerous stressors that cause ecosystem change including land use change, pollution, eutrophication, invasion of exotic species, and acid precipitation. Climate changing should be considered as another agent of change acting in concert with other ecosystem stress. All over the world in many ecosystems, flora and fauna were affected with global warming and change of ecological environment change that many species in flora and fauna were under stress and some of them were lost the defense of ecological stress. Reduction of species number was also important effect on habitat. In this paper, effects of global change on different ecological systems were written.

**Keywords:** Global warming, environment, soil, fauna, flora, habitat, ecological niche

## Küresel İklim Değişikliğinin Ekoloji Üzerine Etkileri

### Özet

İklim özellikleri insan faaliyetleri ve küresel ekoloji, içinde bulunan ekosistemi sınırlayıcı etkilere sahiptir. İklim değişikliği, kuraklık, sel şiddeti ve sıklığındaki değişiklikler; su kaynağı; hava, toprak ve su kalitesi; Ekosistem sağlığı; insan sağlığı; kaynak kullanımı ve ekonomi üzerinde etkilere sahiptir. İklim değişikliği birden farklı yol aracılığıyla etki edebilir; küresel ekosistem üzerinde etkileşimleri ve farklı yollarla etkileri olabilir. Ekosistem ortamında, arazi kullanımı değişikliği, kirlilik, ötrofikasyon, egzotik türlerin istilası ve asit yağış dâhil olmak üzere zaten ekosistemin değişimine sayısız stres nedeni vardır. İklim değişikliği, diğer ekosistem stres ile uyum içinde hareket eden başka bir değişim ajanı olarak kabul edilmelidir. Dünyada birçok ekosistemde, flora ve fauna içinde birçok türün zaten stres altında olduğu, küresel ısınma ve ekolojik çevre değişikliği ile etkilendiğini, ve flora ve fauna üyelerinin bazıları ekolojik strese karşı savunmayı kaybettiği bilinmektedir. Türlerin sayısı azalmakta ve yaşam şartları üzerine önemli etkisi olmaktadır. Bu makalede, farklı ekolojik sistemler üzerine küresel değişimin etkileri insan faktörü, doğal yaşam, küresel ısınma ve sosyo-ekonomik faktörler de dikkate alınarak incelenmiştir.

**Anahtar Kelimeler:** Küresel ısınma, çevre, toprak, fauna, flora, habitat, ekolojik niş

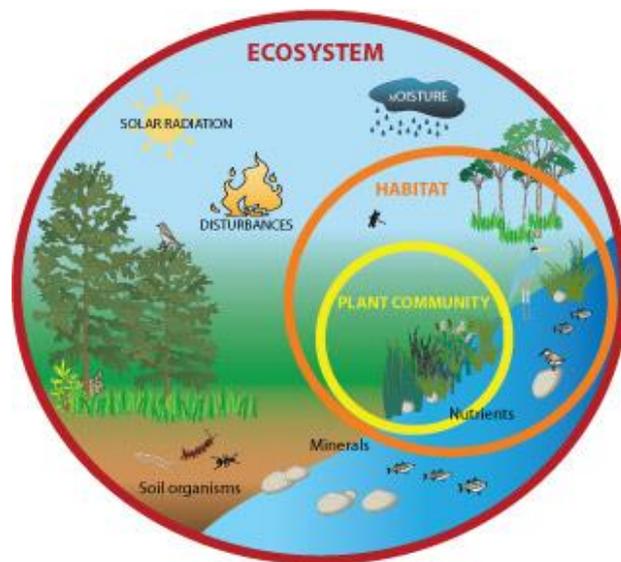
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## Introduction

The impacts of global climate change on ecology are increasing day by day because of the human activity and other natural factors. In order to understand these impacts, it should be understood how the climate is changing. The first important factor representing climate change is increase of temperatures. The average global temperature has increased nearly 0.7 °C since 1850. Also, according to prediction, the global temperature of earth will increase more than 4.5 °C between 1990 and 2100 if the current trend of greenhouse gases (GHGs) emission continues. Moreover, warmer temperatures not only cause glaciers and land ice to melt which adds more water to the oceans but also cause seawater to expand in volume as it warms. Models indicate that sea levels may rise 2 feet or more by 2100 compared to 1990 levels. The other factor is acidification of water bodies. Because of the increase in CO<sub>2</sub> concentration in the atmosphere, the amount of CO<sub>2</sub> dissolving in the water bodies increase and causes the acidification problem. The last factor reflecting the global climate change is alterations in the water cycle and extreme weather conditions [URL-1].

The main purpose of this paper is investigating the effects of global climate change on different ecological systems. In order to understand these effects, the meaning of ecological systems should be defined clearly. Ecological systems represent repeating groups of biological communities that are found in similar physical environments and are influenced by similar dynamic ecological processes, such as fire or flooding.

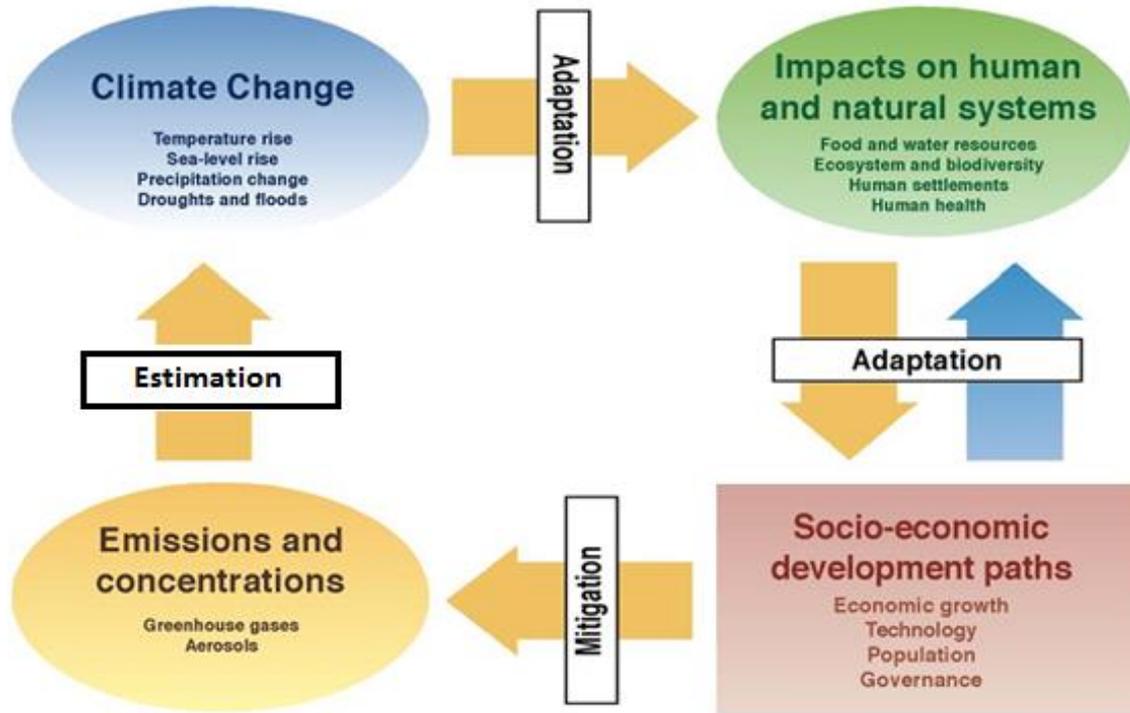
According to Figure 1, the connection between ecosystems and ecological systems can be seen clearly. Ecosystem includes a community and its physical environment which are behaving together as a functional system. The plant community is the part of a habitat and together with the other living creatures is affected from some forces like rain storms or fire events. They are all the part of a big picture, ecosystem.



**Figure 1.** The schematic representation of an ecosystem

The climate change is part of an integrated framework. The effects of it on ecosystems could be explained clearly with this framework. The emissions and concentrations of the greenhouse gases especially the CO<sub>2</sub> whose concentration is higher than other gases in the atmosphere and aerosols causes the climate change. The climate change has impacts on humans and the other natural systems which are ecosystems and biodiversity, water sources and food chains. The climate change impacts on ecosystems

vice versa affect the socio-economic development paths like technology, population, economic growth. Finally, these socio-economic paths impact the emissions and concentrations of greenhouse gases. In Figure 2, the integrated framework related to climate change is given [URL-2].



**Figure 2.** Integrated Framework related to Climate Change

### Emmissions, Climate Change and Ecosystems

The mostly known greenhouse gases are carbon dioxide (CO<sub>2</sub>), methane (CH<sub>4</sub>), Nitrous oxide (N<sub>2</sub>O), nitrogen trifluoride (NF<sub>3</sub>), perflurocarbons (PFCs), hydrofluorcarbons (HFCs), and sulphur hexafluoride (SF<sub>6</sub>) [URL-3]. The GHG emissions are seemed as air pollutant in simple point of view. However, they have important features which make them different from other air pollutants.

GHGs, and especially carbon dioxide, are emitted from many numbers of sources which can be both natural and anthropogenic and their amount also can be higher or lower. The emissions of these gases are distributed to the atmosphere rapidly and uniformly. Because they have global impacts, their contribution to the global concentrations is equally distributed wherever they are emitted. Unlike many conventional air pollutants, local concentrations of GHGs are not greater near large sources than they are in areas far away [URL-3].

Carbon dioxide equivalent (CO<sub>2</sub>) is the preferred measure for determining GHG emissions rates for any combination of these GHGs. Emissions of greenhouse gases are typically expressed in a common metric, so that their impacts can be directly compared, as some gases have a higher global warming potential (GWP) than others.

Greenhouse gas emissions in the 21<sup>st</sup> century can set in motion large-scale, high-impact changes in ecological systems over the coming decades. Sustained warming of a few degree Celsius leads to an increase in sea level of several meters due to loss of Greenland and Antarctic Ice. There will be given some examples related to emissions and ecological impacts of them.

Because of the human activities, the CO<sub>2</sub> amounts in the atmosphere increase. One of the main impacts of this increase is the acidification of water bodies. Atmospheric carbon dioxide dissolves into the water and makes a reaction with H<sub>2</sub>O. This reaction produces carbonic acid (H<sub>2</sub>CO<sub>3</sub>) which produces bicarbonate and hydrogen ions in water. The marine animals require carbonate ion in order to protect their shells and skeletons and hydrogen ions make reaction with these carbonate ions. Thus, the skeletons and shells of marine organisms are destroyed that means acidification may cause serious harm to marine organisms such as corals, lobsters, and sea urchins.

Moreover, the climate change and resulting temperature rise cause severe damage to the Arctic Ice. The polar bears have evolved for a life on sea ice and their only food source, seals, lives on that ice. If ice melts, the only food source of polar bears dies so their survival rates are affected from this situation. Also, because of the lack of food, their body condition drops. The survival rates of baby polar bears decreases and the drowning and the cannibalism incidents increase. Therefore, the climate change impacts on ecosystem and biodiversity directly lead to the extinction of the species [URL-4].

Furthermore, the water cycle is affected from climate change negatively and the balance between water and atmospheric events is destroyed. High temperatures cause high evaporation rates. The warmer the air become, the more water will vapor which leads to the intense rainstorms. Rainstorms increase the flooding, that much of water runs into the rivers and streams, which makes the soil drier. Combined with temperature rise, this causes the drought lands. Projections indicate that on average dry areas will tend to get drier, and wet areas will tend to get wetter.

Curtis, et al. (2006) stated that atmospheric pollutants linked too many types of health problems of many body systems including the respiratory, cardiovascular, immunological, hematological, neurological and reproductive/developmental systems. On the other hand, Barnett et al., (2005) determined that higher airborne levels of PM<sub>10</sub>, NO<sub>x</sub> and SO<sub>2</sub> were all associated with significantly higher rates of childhood hospital admissions for pneumonia and acute bronchitis. Romieu et al., (1997) and Zemp et al., (1999) stated that significantly higher levels of chronic cough and phlegm production have been found in children exposed to higher ambient ozone (O<sub>3</sub>) levels and in adults exposed to higher ambient PM<sub>10</sub> levels. Inhaling such fine sand can cause a syndrome called El Eskan Disease, which involves a variety of respiratory and immunological problems. Recent investigations (Dursun, 2014a,b) have been showed that global warming, climate change and effect of these changes on ecosystem is still continuous in recent years (Ozturk et al, 2015).

## **Conclusion**

Global climate change has adverse effects on ecosystems. Because of the high temperatures and other factors such as sea level rise and precipitation change, climate change impacts the relative abundance of species leading to extinction. CO<sub>2</sub> emissions cause the body waters acidifications leading to damage the aquatic life. Higher temperatures lead to the flooding and the land drought so the living creatures in those areas damages. The climate challenge is large and complex. But it is very likely that many people, working from many angles, can help address climate change and its ecological consequences.

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