

## **Climate Changes and Carbon Sinks**

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**ABSTRACT:** Climate change, normally a highly scientific issue, has in the last many decades become a highly contentious and political issue. Climate change impacts' assesses the potential effects of climate change on the natural environment as well as on human societies and our economies. Climate change impacts will increase significantly as global temperature rises. Climate change will affect the return period and severity of floods, droughts, heat waves, and storms. Coastal cities and towns will be especially vulnerable as sea-level rise will worsen the effects of floods and storm surges. Water and food security and public health will become the most important problems facing all countries. Climate change also threatens global biodiversity and the wellbeing of billions of people. Increase in the atmospheric concentration of carbon dioxide (CO<sub>2</sub>) from fossil fuel combustion and land use change necessitates identification of challenges of climate change can be effectively overcome by the storage of carbon in terrestrial carbon sinks viz. plants, plant products and soils for long surface and ground waters, and reduces the rate of enrichment of atmospheric CO<sub>2</sub> by offsetting emissions due to fossil fuel. Carbon sequestration is a growing research topic that addresses one important aspect of an overall strategy for carbon management to help mitigate the increasing emissions of CO<sub>2</sub> into the atmosphere. Thus, terrestrial ecosystems being recognized as an important component of Carbon (C) cycle, have gained importance owing to its potential to sequester carbon.

**Keywords:** Climate changes; carbon sink; global issues; carbon dioxide

### **INTRODUCTION**

It is a change which is attributed directly or indirectly to human activity that alter the composition of the global atmosphere and which is in addition to natural climate variability observed over comparative time periods. Climate is the average weather pattern over many years; it is not the weather. Climate dictates what parts of the planet tend to be warmer, colder, wetter, drier, and how often we see extreme weather events such a hurricanes. The earth's climate has been changing for millions of years, but since the 1970s scientists have reported increases in greenhouse gases (carbon dioxide, methane) in the atmosphere due to human activities such as the burning of fossil fuels, large scale agriculture, deforestation, etc. The graph below shows that for hundreds of thousands of years carbon dioxide (CO<sub>2</sub>) has never been above 300 parts per million, until recently. Scientists actively work to understand past and future climate by using observations and theoretical models.

#### **What is Climate Change Adaptation?**

We can adapt to climate changes by adjusting how we live and the choices we make. Making these adjustments will help decrease the negative effects of the changing climate, and allow us to take advantage of any new and favorable opportunities.

#### **Examples of adaptation measures can include:**

Choosing not to build houses in flood plains. Having a storm emergency kit and evacuation plan. Relocating houses from at-risk areas over time. Maintaining natural buffers to floods (wetlands, stream vegetation). Adjusting storm water and sewage infrastructure either by moving them, or by increasing their capacity.

Reducing run-off and the burden on storm water infrastructure by increasing permeable pavements, and increasing tree and vegetation covers.

Growing new foods better suited to a hotter climate.

#### **Is it too late to do anything about Climate Change?**

No! We can use 'mitigation' which refers to the things done to lower greenhouse gases in the air, to slow down the rising temperatures around the world. Here are some ways to cut your carbon use and reduce green house gas emissions:

- Install solar panels for hot water
- Get rid of oil heating and install a heat pump
- Drive a small fuel efficient car, or better yet, buy a hybrid or electric car
- Join a ride share or car share program, carpool, take the bus, ride your bike or walk more often
- Eat local food, eat less meat
- Choose organic foods
- Choose energy efficient appliances
- Insulate your home so you use less heat
- Compost, recycle, reduce, re-use

**Reasons for the Interest in Climate Change:** When we talk about climate change, we mean any long-term change in the average weather patterns in a particular area. Average weather patterns include average temperature, rainfall, wind conditions and numerous other climatic conditions. These changes may take place due to the dynamic processes of the Earth (e.g. volcano eruptions or earthquakes), due to external forces (e.g. changes in the intensity of solar radiation or fall of large meteorites), or due to human activities (e.g. deforestation, tree burning or the three types of pollu-

tion – land, air and sea), resulting in an ecological imbalance, the disappearance of certain animal and plant species, and the appearance of others. Climate change has brought many environmental risks to human health, such as ozone layer depletion, loss of biodiversity, increased pressures on food-producing systems and spread of infectious diseases. The three main categories of climate change impact on human health are:

- Direct impact (e.g. as a result of heat waves, large-scale air pollution, natural disasters).
- Impact on ecosystems and environmental relationships (e.g. damage to agricultural crops, overabundance of mosquitoes, depletion of marine species).
- Indirect impact (e.g. poverty, displacement, conflict over resources such as water, post-disaster epidemics).
- Earth orbital changes.

#### HUMAN CAUSES

- Greenhouse Gases (Anthropogenic Or Man-Made Causes)
- Deforestation
- Coal Mining
- Burning Of Fossil Fuels
- Industrial Processes
- Agriculture

#### Human Activities that Affect the Carbon Cycle:

The carbon cycle involves the movement of carbon between the atmosphere, biosphere, oceans and Ecosphere. Since the Industrial Revolution approximately 150 years ago, human activities such as the burning of fossil fuels and deforestation have begun to have an effect on the carbon cycle and the rise of carbon dioxide in the atmosphere. Human activities affect the carbon cycle through emissions of carbon dioxide (sources) and removal of carbon dioxide (sinks). The carbon cycle can be affected when carbon dioxide is either released into the atmosphere or removed from the atmosphere.

#### BURNING OF FOSSIL FUELS

When oil or coal is burned, carbon is released into the atmosphere at a faster rate than it is removed. As a result, the concentration of carbon dioxide in the atmosphere increases. Natural gas, oil and coal are fossil fuels that are commonly burned to generate electricity in power plants, for transportation, in homes and in other industrial complexes.

**Carbon Sequestration:** When plants remove carbon dioxide from the air and store it, the process is called carbon sequestration. Agricultural and forestry methods can affect how much carbon dioxide is removed from the atmosphere and stored by the plants. These

sinks of carbon dioxide can be farms, grasslands or forests. Human activity in managing farmland or forests affects the amount of carbon dioxide removed from the atmosphere by plants and trees. These sinks of carbon dioxide affect the carbon cycle by decreasing the amount of carbon dioxide in the air.

**Deforestation:** Deforestation is the permanent removal of trees from forests. Permanent removal of the trees means new trees will not be replanted. This large-scale removal of trees from forests by people results in increased levels of carbon dioxide in the atmosphere because trees are no longer absorbing carbon dioxide for photosynthesis. As a result, the carbon cycle is affected. According to National Geographic, agriculture is the primary cause of deforestation. Farmers remove trees on a large-scale basis to increase acreage for crops and livestock.

**Geologic Sequestration:** Human activity can affect the carbon cycle by capturing carbon dioxide and storing it underground rather than permitting it to be released into the atmosphere. This process is called geologic sequestration. According to the U.S. Environmental Protection Agency, geologic sequestration could retain large quantities of carbon dioxide for extended periods of time and consequently reduce the concentrations of carbon dioxide above-ground.

**Green House Effect:** Greenhouse gasses trap heat in the earth's atmosphere and cause the overall temperature to rise (as described in the diagram below). The earth's climate is in a careful balance so even a small overall rise in the average global temperature will affect the climate. Rising temperatures also melt glaciers, icebergs, permanent ice fields and permafrost, which will lead to rising sea levels.

#### EFFECTS OF CLIMATE CHANGES

**Climate Change on Forests:** The world's forests influence climate through physical, chemical, and biological processes that affect planetary energetic, the hydrologic cycle, and atmospheric composition. These complex and nonlinear forest-atmosphere interactions can dampen or amplify anthropogenic climate change. Tropical, temperate, and boreal reforestation and a forestation attenuate global warming through carbon sequestration. Bio-geophysical feedbacks can enhance or diminish this negative climate forcing. Tropical forests mitigate warming through evaporative cooling, but the low albedo of boreal forests is a positive climate forcing. The evaporative effect of temperate forests is unclear. The net climate forcing from these and other processes is not known. Forests are under tremendous pressure from global change. Interdisciplinary science that integrates knowledge of the many interacting climate services of forests with the impacts of global change is necessary to identify and

understand as yet unexplored feedbacks in the Earth system and the potential of forests to mitigate climate change.

Climate change may also affect the yield of cultivable and wild growing edible vegetable due to unforeseen diseases, pests or spread of invasive species.

For example, in Latvia since 2007, fruit trees are affected by blight disease which is induced by the bacterium *Erwinia amylovora*— its reproduction and spread is affected by moist and warm climatic conditions during the flowering time of fruit trees. Trees affected by this disease perish or have to be disposed particularly such fruit trees and shrubs as apple, pear, hawthorn, quinces, currants etc. Blight affected fruit trees in Latvia have to be disposed by Incineration.

**Climate Change on Respirations:** Plant respiration is a large, environmentally sensitive component of the ecosystem carbon balance, and net ecosystem carbon flux will change as the balance between photosynthesis and respiration changes. Partitioning respiration into the functional components of construction, maintenance, and ion uptake will aid the estimation of plant respiration for ecosystems. Maintenance respiration is the component most sensitive to changes in temperature, CO<sub>2</sub>, protein concentration and turnover, water stress, and atmospheric pollutants.

**Climate Change on Water Resources:** Water is a naturally circulating resource that is constantly recharged. Therefore, even though the stocks of water in natural and artificial reservoirs are helpful to increase the available water resources for human society, the flow of water should be the main focus in water resources assessments. The climate system puts an upper limit on the circulation rate of available renewable freshwater resources (RFWR). Although current global withdrawals are well below the upper limit, more than two billion people live in highly water-stressed areas because of the uneven distribution of RFWR in time and space. Climate change is expected to accelerate water cycles and thereby increase the available RFWR. This would slow down the increase of people living under water stress; however, changes in seasonal patterns and increasing probability of extreme events may offset this effect. Reducing current vulnerability will be the first step to prepare for such anticipated changes.

**Climate change on Ecological responses:** There is now ample evidence of the ecological impacts of recent climate change, from polar terrestrial to tropical marine environments. The responses of both flora and fauna span an array of ecosystems and organizational hierarchies, from the species to the community levels. Despite continued uncertainty as to community and ecosystem trajectories under global change, our review exposes a coherent pattern of ecological change

across systems. Although we are only at an early stage in the projected trends of global warming, ecological responses to recent climate change are already clearly visible.

**Climate Change on Human Health:** Health is a physical, emotional and social well-being—impact of climate change on human health may be associated with prevalence of various diseases, without the aforementioned, encouraging also the emergence of mental disorders as well as cancer and other diseases induced by specific factors.

Natural disasters or exceptional environmental conditions and the resulting forced migration of population can affect a person's cognitive functioning (thinking), emotional and behavioral level, changing the mental state of many people, especially children - inducing stress, anxiety and panic attacks, depression etc.

To diminish consequences of climate change effects on human health or to prevent impacts, important role is attributed to support of the population, which can be delivered by governmental attitude towards the society, for instance—Strengthening social support networks, improving environmental safety and access to health care by raising public awareness of the risks and emergency situations, reducing economic instability.

**Climate Changes on word Food Supply:** A global assessment of the potential impact of climate change on word food supply suggests that doubling of the atmospheric carbon dioxide concentration will lead to decrease in global crop production.

**Climate Change on World Agriculture:** Recent studies suggest that possible global increases in temperature and changes in temperature and changes in precipitation patterns during the next century will affect world agriculture. Because of the ability of the farmer to adapt, however these changes are not likely to imperil world food production. Nevertheless, world production of all goods and services may decline, if climate change is severe enough or if cropland expansion is hindered. Impacts are not equally distributed around the world.

## CARBON SINKS

A carbon sink is a natural or artificial reservoir that accumulates and stores some carbon-containing chemical compound for an indefinite period. The process by which carbon sinks remove carbon dioxide (CO<sub>2</sub>) from the atmosphere is known as carbon sequestration. Public awareness of the significance of CO<sub>2</sub>sinks has grown since passage of the Kyoto Protocol, which promotes their use as a form of carbon offset. There are also different strategies used to enhance this process.

**The natural sinks are:** Absorption of carbon dioxide by the oceans via physicochemical and biological processes. Photosynthesis by terrestrial plants

**Carbon sources include:** Combustion of fossil fuels (coal, natural gas, and oil) by humans for energy and transportation. Farmland (by animal respiration); there are proposals for improvements in farming practices to reverse this. The world's forests take up around a third of human-caused CO<sub>2</sub> emissions, playing a critical role in helping to moderate climate change. But as temperatures rise, scientists are concerned the delicate balance of how trees use CO<sub>2</sub> could be upset, potentially reducing their capacity to buffer rising CO<sub>2</sub> levels. A new Nature study suggests that trees are able to adapt to rising temperatures better than previously thought. But it's only partially good news, the researchers say, as warmer conditions will still see the buffering effect from trees reduced.

## CONCLUSIONS

Science indicates that our planet faces dramatic and lasting changes due to warming of our global surface temperature. Unless we take significant Climate change is a global problem today. The continuing change in climate across the world is posing threat to our environment and society as a whole with no clear remedy. It is happening due to the continuous rise in temperature which is very injurious for the mankind as it is directly affecting our health. The sudden increase in temperature leads to high heat waves during summers and lesser cold waves during winters. Climate change is also resulting in frequently extreme droughts, floods, landslides and hurricanes, etc. We should change our habits positively in order to reduce waste by choosing the use of reusable products instead of disposable one. We should buy products having minimal packaging to reduce amount of wastes. We should recycle paper, newspaper, glasses, aluminum cans, etc. If we start recycling at least half of your household wastes, we can save approximately 2,400 pounds of carbon dioxide emission every year. We should reduce the need of electric use such as air condition, hair drier, room heater, etc. We should make the habit of turn down lights while sleeping at night or day when we go outside. We should replace our regular bulbs with the compact fluorescent light (CFL) bulbs. Regular use of the CFL instead of regular light bulbs would help in eliminating around 90 billion pounds of greenhouse gases from the atmosphere. We should try to drive less and in very smart way for the fewer harmful gas emissions. Together with changing our own habits, we should encourage others to conserve energy by reducing lights use as much as possible.

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