

Estimating Carbon Dioxide [CO₂] Emission from Global Deforestation and Its' Effects on Climate Change

Odia O. Osadolor

*Mechanical Engineering Department,
Ambrose Alli University, Ekpoma, Nigeria*

Uwhubetine O. Best

*Mechanical Engineering Department
Delta State Polytechnic, Otefe-Oghara, Nigeria
Received 18 March 2021; Accepted 02 April 2021*

Abstract

Today, forests which act as sinks for carbon dioxide (CO₂), (one of the greenhouse gases) are threatened with deforestation. It takes millions of years for today's forest to have evolved. Forests maintain conditions that make life possible. Global forest is largely destroyed today by farmers and loggers for agriculture and selling of wood respectively. Deforestation is the cutting down or burning of forests permanently so that the land is available for other usage. One of the main sources of carbon dioxide, CO₂ (a greenhouse gas) is deforestation by burning. One of the dangers of greenhouse gases is global warming leading to climate change. The study gathered relevant data which were subjected to analysis using Micro Soft (MS) Excel. The results from the analysis indicated that between pre industrial era and 2010 it was estimated that 18.30 million km² of deforestation had taken place and this had released 366,000 million tonnes of CO₂ into the atmosphere. The analysis was used to forecast production of deforestation and CO₂. The study further concluded and recommended ways to decreasing the quantity of CO₂ in the air.

Keywords: Forest, Deforestation, Climate Change, Carbon dioxide, Emitted

I. INTRODUCTION

It takes millions of years for today's forest to have evolved. History of existence of humans can be said to be as equal to that of forests and their uses. Forests maintain conditions that make life possible. Over half of the animals and plants specie in the globe (world) live in tropical forest. Forest is place having huge amount of trees. Forest can also be said to be any place with high amount of packed vegetation, vegetation under the water like kelp forests, or fungi and bacteria which are non-vegetation. Forests are important to man's life because they supply a multiple range of resources like reduce natural hazards such as floods, help to regulating the planetary climate, purify water and storage of carbon.

Forest is found in any area that is able to preserving the growth of trees except where natural fire occurs, or where the region has been altered by human activities. Forests also housed animals and plant species, and biomass per unit area is huge when compared to other vegetation community.

Forest is classified in different ways and to different degrees of specificity. According to Jenkins and Groombridge (2007), there exist 26 major types of forests and these are classified into 6 broader categories namely

- (1) temperate needle leaf,
- (2) temperate broadleaf and mixed,
- (3) tropical moist,
- (4) tropical dry,
- (5) sparse trees and parkland,
- (6) forest plantations.

The role of man in the removal of forest (deforestation) is considerable and extensive. Many activities that contribute to the losing of forest including fires, road construction, cattle ranching, subsistence activities, oil extraction, collection of fuel wood and building material, mining, war, logging, commercial agriculture, hunting, hydroelectric projects poaching, and pollution

One main supplier of carbon dioxide CO₂ which is one of the greenhouse gases is deforestation by fire.

Greenhouse gases which include water vapour 36%-70%, carbon dioxide 9%-26%, methane 4%-9%, ozone 3%-7% etc, (Kiehl, Kelvin and Trenberth, 1997) exist in the atmosphere and are produced by natural phenomena (decomposition, ocean release, respiration) and through human activities. Greenhouse gases are

injurious to the environment. The most common greenhouse gas is the Carbon dioxide, CO₂. Greenhouse gases behave like the glass on a greenhouse. They make it possible for solar radiation pass through the atmosphere, and make it impossible the counter radiation's escape back into space. These greenhouse gases attract counter radiation and release it back towards the Earth, causing an increase in the earth's temperature which is averagely approximately 15°C today. This natural process is an important part of the planet to support living things on earth. Non existence of this process would have made the average temperature of the earth to be approximately - 18°C. Global warming is one of the hazards of greenhouse gases that lead to climate change.

Climate change is a long term change in the earth's climate while global warming is the increase in the mean surface temperature of the earth due to increasing level of greenhouse gases (NASA, nd). Simply put, global warming refers to increasing temperature of the earth while climate change includes warming and its side effect. The side effect include rising sea level, shrinking of glaciers, increase in heat waves, extreme storm and flood, increase in drought, spread and increase of diseases, economic consequence (damage to property by flood, treatment of sickness, etc), conflict and war, loss of biodiversity (loss and endangerment of species) and destruction of ecosystem (increase in carbon dioxide will put the ecosystem to test, pollute the air etc;) (Maria, 2013).

II. JUSTIFICATION OF THE STUDY

The continuous activities of road construction, mining, oil extraction, logging, fires, commercial agriculture, pollution, hydroelectric projects, , collection of fuel wood, cattle ranching, building material, and hunting is leading to depletion of forest. The continuous depletion of forest (which serves as a natural sink to CO₂) and increase of climate change is undesirable and of great concern. The study presents data on the estimation of production levels of CO₂ through deforestation, effects on the environment (global warming) and removal of CO₂ emission from the atmosphere through new technology with a view to making it one of the viable tools that can be used for new approaches to tackling global warming.

III. OBJECTIVES OF THE STUDY

The overall aim of this study is to investigate the role of deforestation to climate change. The specific objectives include the followings

- (i) To estimate global deforestation between pre industrial era to 2010
- (ii) To estimate the amount of carbon dioxide (CO₂) released into the atmosphere during deforestation which has continued to increase global warming.

IV. RESEARCH METHOD

The method of data collection to be used in this study is quantitative. This includes careful study of old and new literature both hard and soft copies.

Data collected and generated will be subjected to MicroSoft (MS) Excel to determine trend equations global cumulative deforestation

The formats for presentation would be table and graph, and the relevant tools for utilization will be MS excel.

V. DEFORESTATION SIZE

Over a period of 5000 years, 18.3 million km² is the estimated cumulative global deforestation, that is, an average net loss of 3600 km² per year (FAO, 2012). Below is table 1 showing global cumulative deforestation from the year 1800 to the year 2010.

Table 1: Global Cumulative Deforestation

Year	Deforestation (million km ²)
1800	8.40
1810	8.80
1820	9.00
1830	9.30
1840	9.50
1850	9.70
1860	10.0
1870	10.40
1880	10.80
1890	11.30
1900	11.70
1910	12.20

1920	12.90
1930	13.30
1940	13.80
1950	14.40
1960	15.10
1970	15.60
1980	16.30
1990	17.3
2000	17.70
2010	18.30

Source: Food Agriculture Organisation (FAO), 2012: State of the world's forests

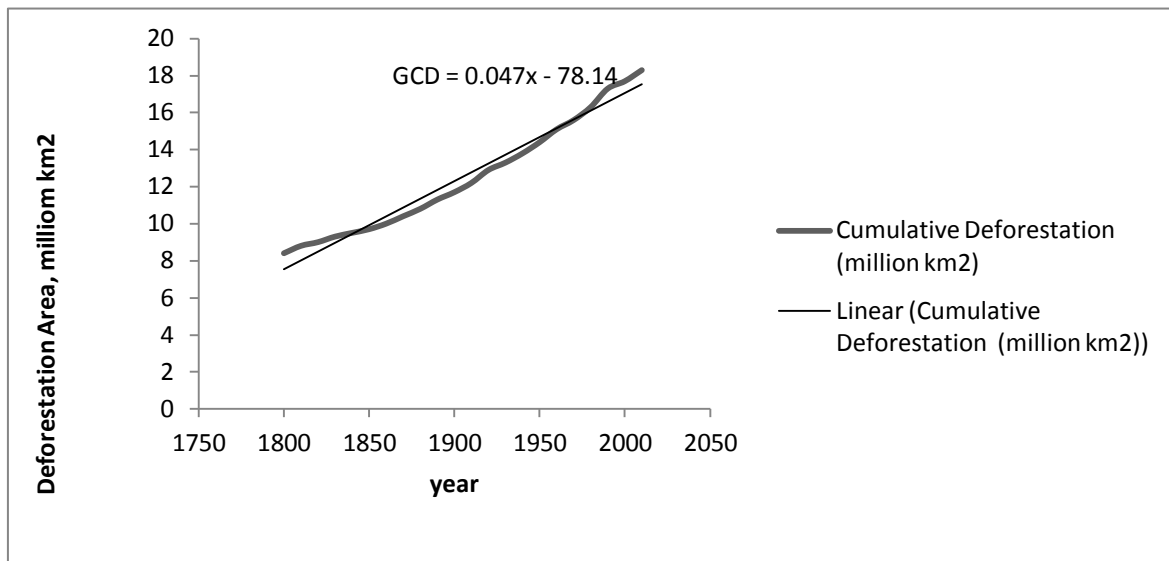


Fig. 1: A graph of deforestation area against year

VI. TREND EQUATION OF THE GRAPH AND ESTIMATION OF CARBON DIOXIDE (CO₂) EMITTED BY DEFORESTATION

Using the Microsoft Excel software, the above Fig. 1 was generated and regression trend equation was generated which is given as;

$$GCD = 0.047x - 78.14 \quad (\text{Eqn. 1})$$

Where GCD is global cumulative deforestation at a particular year (time, t). From the trend equation, global cumulative deforestation estimate stands at 18.21 million square kilometres in 2050.

Trees absorb CO₂ through the process of photosynthesis. When plants die and decay or burnt, CO₂ is released into the atmosphere. As forest and grassland are cleared, the amount of carbon released into the atmosphere is 20,000 tonnes per square kilometre (Intergovernmental Panel on Climate Change, IPCC, 2006).

Total amount of deforestation from pre industrial era to 2010 was 18.30 million km²

18300000 will release (18300000 x 20000) = 3.66E11 tonnes of CO₂

That is 366,000 million tones CO₂ was released from 1800 to 2010

Also, in the year 2010, 0.6 million km² of deforestation took place (see Table 1)

Therefore, 0.6 million km² of deforestation will release (0.6 million x 20,000) = 1.2E10.

That is 12,000 million tones of CO₂ was released 2010 by deforestation.

VII. CONCLUSION

Table 1 indicates that deforestation is on the increase. It also shows that deforest from pre industrial era to 2010 is estimated to be 18.30 million square kilometer (km²) which had emitted 366,000 million tonnes of CO₂. This implies that forest that would have act as a reservoir for carbon dioxide or removal carbon dioxide from the atmosphere is on the decrease making it possible for carbon dioxide to be emitted to the atmosphere (without no reservoir to store CO₂) which is harmful to the existence of man and the earth. Deforestation also causes serious changes in how carbon is stored in the soil. When deforestation takes place, CO₂ emission is

created by both soil disturbance and increased rate of decomposition. This also increases soil erosion and nutrient leaching which further reduces the area's ability to act as a carbon sink.

The natural derivations of CO₂ include ocean release, plant and animal respiration, organism respiration and decomposition, volcanic eruption and forest fire. IPCC (2006) concluded that about the same amount of CO₂ from the atmosphere that are produced by natural source is remove by carbon sink. It further went on that human generations of CO₂ are smaller than natural sources but they have disrupt the natural balance that was in existence for many years before the activities of human

VIII. RECOMMENDATION

World Carfree Network (WCN) opined that trucks and cars account for about fourteen percent (14%) of world carbon emissions, while most researchers agreed deforestation account for fifteen percent (15%) of global carbon emission. The summary is that man should do much to preserve forestation as man increases fuel efficiency, man comfort, reduction in automobile usage etc. Any real plan to reduce global warming and to avoid dangerous consequences on human, must rely in part on preventing deforestation. To reduce the amount of green house gas (carbon dioxide, CO₂) and global warming the followings are recommended

(i) Less trees means less absorption of green house gas which is in itself responsible for increase in global warming due to carbon emission that is the most important / destructive green house gas. Global warming could be stopped or slow down by reducing forest degradation and deforestation.

(ii) One the ways some tropical countries are increasing forestation is by partaking in the United Nations' Reducing Emissions from Deforestation and Forest Degradation (REDD) program. REDD is to provide incentives for those countries who care for their forest and manage it sustainably while still being able to benefit economically. Examples include not using large land area, that is, cutting fewer trees for activities such as meat and milk production and coffee growing. Nations that participate in this program will then incur and sell carbon pollution credits once they prove to have reduced deforestation below a certain line.

(iii) Countries / Governments should avail themselves the opportunity to make proper use of Global Forest Watch 2.0, Achim (2013) opined that this is to take the advantage of the remote sensing technology that shows high resolution and deforestation maps. This system will make it possible for global deforestation alerts to establish deforestation hotspots and illegal logging with the aid of combination satellite.

(iv) The usage of drone within forestry operation which is relatively new (Brad, 2017), this should be highly encouraged as the drone footage can be used to make ortho maps (allows one to process images of drones to produce geo referenced product) of area to aid visualizing the terrain on the map.

REFERENCES

- [1]. Achim, S (2013). Saving the World Forest: A Technology Revolution to Curb Illegal Logging. The Gurdian International Edition
www.theguardian.com/sustainable-business/saving-forest-technology-illegal-logging
- [2]. Brad, C (2017). Technology in Forestry. The greenest workforce
www.thegreenestworkforce.ca/index.php/blog/blog-full/technoogy-in-forestry
- [3]. FAO (2012). Africa – Food and Agriculture
www.fao.org/docrep/018/.../i13137epdf
- [4]. Intergovernmental Panel on Climate Change (IPCC) (2006). 2006 IPCC Guidelines for National Greenhouse Gas Inventories. Inter-governmental on Panel Climate Change, Geneva, Switzerland.
www.epa.gov/cleanenergy/energy-resources/refs.html
- [5]. Jenkins M.D. and Groombridge. B (2007). World Atlas of Biodiversity: Earth's Living Resources in the 21st Century. World Conservation Monitoring Centre, United Nations Environment Programme
- [6]. Kiehl, J. T; Kevin E. & Trenberth (1997). "Earth's Annual Global Mean Energy Budget" (PDF). Bulletin of the American Meteorological Society **78** (2): 197–208.
- [7]. Maria,T(2013). Top 10 Worst Effects of Global Warming. <http://dsc.discovery.com/tv-shows/curiosity/topics/worst-effects-global-warming.htm>
- [8]. NASA (nd). Whats in Name? Global Warming vs Climate Change
www.pmm.nasa.gov/education/articles/what-name-global-warming-vs-climate-change
- [9]. World Carfree Network (nd). Deforestation and its Extreme Effects on Global Warming.
www.scientificamerican.com/article/deforestation-and-global-warming