

Controlling Greenhouse Gas Emission and Global Warming Prevention: Countermeasures for Sub-Saharan African

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Abstract

Carbon dioxide emission (CO₂) is the principal element of greenhouse gases (GHG), contributing a greater portion of 50% equivalent to global warming. The effort to control the increase of atmospheric CO₂ emission awareness is an essential elucidation to curtail global warming challenge. Through the protection of existing forests and increasing the preservation of the woodland storage, carbon sequestration by forest areas can be efficiently elevated. CO₂ emissions from forests to the atmosphere to the large extent may be prevented by promoting the long-time period use of woods and reprocessing without burning. When effective land use plans are formulated, the use of agricultural land which forms part of sub-Saharan arable land deforestation will reduce. Holistically, moderating the exerting of carbon sequestration characteristic of vegetation by protecting the original forest areas, wetland and marsh vegetation as far as possible can effectively control CO₂ emissions and improve environmental quality. In the long-term, the technological innovation, development, and utilization of alternative energy sources like fossil energy will mitigate CO₂ emissions. Household emission form contributes a significant amount CO₂ emission hence, the adaptation to new energy-saving ecological lifestyle will be an important part of controlling greenhouse gas emissions.

Keywords: Greenhouse Gas; Global Warming; Carbon dioxide emission; deforestation; ecosystem

1.0 Introduction

Global warming has upsurge to become the world's challengeable phenomenon and a potential destruction to the human ecosystem. The elevation of atmospheric CO₂ concentration, the greenhouse effect is resulting in the warming of the Earth most especially after the Second World War. Develop countries consumed a large amount of energy, resulting in a sharp rise in atmospheric CO₂ concentration. Over the past 100 years, the global average temperature has risen by about 0.5 degrees Celsius. Report my IPCC (Houghton, Jenkins et al. 1990, Change 1996), the continued greenhouse gas emissions which may be at or above the current rates would cause further warming and induce many changes in the global climate-ecosystem in this 21st century. It is highly likely that the GHG emission would be larger than those observed during the 20th century. It has also been estimated by IPCC (Change 1996) that, by the end of this century, the global average temperature will rise by 2 to 3 degrees Celsius (Houghton, Jenkins et al. 1990, Change 1996), and the northern hemisphere average temperature will rise by 3 to 5 degrees Celsius (Le Quéré, Raupach et al. 2009). The impact of global warming on both human and animal ecosystems will manifold. Plants adaptation to the ecosystem is influenced by the geographical area and the pace to this change is estimated to be lower than the change in global warming. Plants species will greatly be endangered by the high change of increase in the temperature.

Human and animal ecosystem is a complex composition of species. Once a species is extinct, other species that have the synergetic relationship with the species will inevitably be endangered. Plants rely on specific insects to pollinate, and once plants or insects are extinct, a plant would immediately become an endangered species. As development progresses, geographic isolation between ecosystem types becomes more and more obvious, which will hinder species from adapting to climate and environmental changes. Currently, the rate of deforestation has increase barriers to species exchange due to agricultural production. Livestock grazing has resulted in the introduction of artificial plant species. Promotion of plant growth can be said a favorable measure to counter the increase of temperature and CO₂ concentration but according to the analysis of CO₂ concentration gradient experiment, this phenomenon is temporary, after a long time, plant growth will return to or below the original level (Change 1996, Le Quéré, Raupach et al. 2009). On the other hand, the rapid change of climate condition can lead to major disturbance in the ecosystem resulting in the occurrence of pest's species and diseases. The increase of temperature and the consequent environmental drought is as a result of the direct manifestation of climate change on the rise. According to (King and Neilson 1992), plants are more responsive and easily affected by environmental drought than by the rising temperature itself.

In a paper published by (Serdeczny, Adams et al. 2017) climate change impact on sub-Saharan Africa, they concluded that changes in terms of global warming challenges are not uniform across the region. It stated that the

East African countries stand the higher risk of flooding and concurrent health impacts and infrastructure damages. The West Africa countries were projected to experience severe impacts on food production, including through declines in oceanic productivity, with severe risks for food security and negative repercussions for human health and employment. South Africa sees the strongest decrease in precipitation with concurrent risks of drought. The climate change will lead to the rise of sea level, some of the lands will be eroded by seawater, small islands which are exposed to the sea may be completely submerged. This may lead to changes in the territorial waters and boundaries of some countries.

Global warming caused by greenhouse gases has attracted the attention of the international community and it is the most important environmental problems in the world. Greenhouse gases include CO₂, CH₄, N₂O, O₃, CFCs and other. However, CO₂ is the most important factor causing global warming, accounting for more than 50% of all greenhouse gases (Houghton, Jenkins et al. 1990, Fujimori 2000). So how to restrain the advancement of atmospheric CO₂ emission concentration, the following countermeasure will play a vital role in restraining global warming.

2.0 Global Strategy to Curb CO₂ Emissions

It is the responsibility and obligation of every citizen on the planet to minimize the impact of global warming in order to avoid adverse global environmental events. To this end, the Intergovernmental Panel on Climate Change (IPCC) was established internationally in 1988, and the Framework Convention on Climate Change for the purpose of stabilizing greenhouse gas concentrations was formulated in 1992 and entered into force in 1994. At the Third Meeting of the Parties held in Kyoto in December 1997, specific numerical targets for the suppression and reduction of greenhouse gases were discussed, and the reduction targets for each country were set. Specifically, in the five-year period from 2008 to 2012, how much should the 1990 emissions be taken as a reference base point? The indicators for the US, EC, and Japan were 7%, 8%, and 6% respectively. The issue of CO₂ uptake by forests was also discussed at the Kyoto meeting, but it was difficult to calculate the amount of CO₂ uptake by forests. At present, scientists from all over the world, including the Africa Union, have been making unremitting efforts to this end, (Mizoguchi, Miyata et al. 2009). Since the Kyoto Conference, the meetings of the Parties have all revolved around how to operate to achieve the reduction targets set out in the Kyoto Protocol. However, at the Fourth Meeting of the Parties, disputes over the strong relationship between countries, especially between developed and developing countries, have not made significant progress, leaving many unresolved issues. Approximately two-thirds of all industrial methane and carbon dioxide released into the atmosphere since 1854 can be traced to burning fossil fuels and producing cement. Over the decades, scientists have succeeded in confidently tracing how much of climate change can be directly tied to human activities, particularly the burning of fossil fuels. Sadly, the carbon dioxide emissions from human activities are now higher than at any point in human history, further worsening the 'greenhouse effect' contributing to global warming and the consequences of climate change. In fact, recent data shows that global carbon dioxide emissions were 150 times higher in 2011 than they were in 1850.

Subsequently, burning fossil fuels is typically a sign of heavy industry, carbon dioxide emissions can also serve as a technique for measuring a country's economic growth. However, a reduction in global greenhouse gas emissions is an imperative objective of not only environmentalists but of every humanitarian-oriented and environmentally conscious state in the world. Currently, Under the Paris Agreement adopted in December 2015, 197 countries agreed to aim to hold the rise in global average temperature to "well below 2 °C above pre-industrial levels" and to pursue efforts to limit it to 1.5. As part of the decision to adopt the agreement, the world's governments mandated the Intergovernmental Panel on Climate Change (IPCC) to prepare a special report in 2018 on the impacts of global warming of 1.5 above pre-industrial levels and related global greenhouse gas emission pathways. (Change 1996)

Established economies have large, but waning, carbon emissions, while new economic giants in the developing world are increasing their emissions rapidly. In the long run, countries must decide on prevention measures to a resolution approach. It is very important to restrict each other's compliance with the minimum CO₂ emissions through the global strategic decisions set by the IPCC. It should, however, be noted that it does not mean that the goal of capping emissions is the goal. In the long run, countries must make plans to prevent global warming.

In order to curb the increase of CO₂ concentration in the atmosphere, sub-Saharan African countries must strive to improve their production and consumption patterns through the use of forest area, agriculture land use and industry emissions. The countries should strive for the environmental protection and CO₂ eco-life, strive to develop energy-saving technologies and deforestation measures Sub-Saharan African countries need to limit the use of fossil fuels and constantly develop alternative energy sources like bioenergy, solar energy, wind power, water power, geothermal energy, and atomic energy just to mention a few. Fossil energy is the discovery of fossilized fossils between hundreds of millions of years ago and tens of millions of years ago, burning into the atmosphere what is completely absent from the Earth's material cycle is the fundamental cause of the continual

rise in atmospheric CO₂ concentration (Fujimori 2000)

3.0 Reduction of CO₂ Emissions through Afforestation.

Carbon storage in terrestrial ecosystems is about three times that in the atmosphere, about 60% of which is stored in forest ecosystems, and forests are absolutely dominant in terms of carbon storage per unit area (Change 1996). If the forest disappears or is destroyed and degenerated, the damaged part will eventually be released into the atmosphere in the form of Carbon emissions, which will increase the atmospheric carbon concentration; on the contrary, if the forest area is enlarged and the forest quality is improved, it will promote the absorption of atmospheric CO₂ and reduce the atmospheric CO₂ concentration (Matthews, Nabuurs et al. 1996).

Many parts sub-Saharan Africa are not suitable for forest growth but are covered by grasslands and other non-forest vegetation, and the vegetation in these areas should be kept as far as possible from destruction. Whether it is forest or grassland, the need to maintain the original state can hold high carbon reserves. In forest ecosystems, soil carbon storage is very high, accounting for 60% of carbon storage in forest ecosystems. No matter what kind of ecosystem, it is very important to protect the soil from damage. When natural vegetation is converted into farmland, the carbon storage in the soil decreases. Therefore, it is necessary to explore tillage techniques to gradually improve the carbon storage capacity of the agricultural land. Promote the sustainable development of agricultural productivity, such a relative surplus of agricultural land, to take measures to return farmland to forests and grasslands, return to the original natural vegetation, thereby increasing carbon storage. The countermeasures to reduce CO₂ through forests and re-greening the deforested regions.

3.1 Fortification of Existing Forests

Protecting the existing forest area and preventing forest degradation can effectively prevent the emission of CO₂ from forest land to the atmosphere, increase the carbon sequestration of the forest, and help to protect biodiversity. Natural forests can produce dead or fallen trees. Although their decomposition slowly releases CO₂ into the atmosphere, it plays an important role in the carbon sequestration capacity of ecosystems and the rational allocation of biodiversity. In addition, the implementation of natural forest protection can effectively prevent soil erosion and promote carbon storage function.

Africa is suffering as twice the world rate according to the United Nations Environment Programme (UNEP). According to a report by (Minami 1995, Thomas, Cameron et al. 2004, Patrick Bakehe 2018) deforestation has already reached 90% of the total West African original forests area. According to FAO, Nigeria lost about 81% of its forest reserve between 1990-2005 within 15 years' interval. DR. Congo has by large depends on the use of wood as firewood and charcoal by the population. This has greatly affected the forest area notwithstanding the consequences the various mining industries have in the forest area.

The tropics, due to the massive cutting of state-owned forests, the living foundations of the indigenous people have been affected and there is no room for farming in accordance with the original technology of burning, farming, and forest restoration, thus aggravating the destruction of forests. The average annual loss of tropical forests is 16.9 million ha. According to the FAO, Nigeria has the world's highest deforestation rate of primary forests. It has lost more than half of its primary forest in the last five years. Causes cited are logging, subsistence agriculture, and the collection of fuelwood. Almost 90% of West Africa's rainforest has been destroyed. To change this situation, we must find out the causes of forest destruction and find ways to solve them. Once the forest becomes farmland, the fertility will gradually decrease and finally become a barren land. Such land cannot be easily restored to the forest for many years, and finally, it can only become a barren grassland. The recovery of forest communities through artificial afforestation is the most effective way to absorb CO₂ in the atmosphere. This requires not only the active efforts of governments but also the support of developed countries to result in wood reprocessing rather than burning.

The economic value of plantations can effectively promote the protection of natural forests. Forest restoration not only has economic benefits, but also has good environmental benefits, disaster prevention benefits, and landscape benefits, and is conducive to carbon storage.

3.2 Increasing Forest Reserves and Reduction of Timber Utilization

The effort to reduce atmospheric CO₂ emission will increase the carbon storage of ecosystem and also actively promote the use of long-term wood. The long-term wood refers to the wood that can be used for quite a long time without decay or burning. This is the way to increase carbon storage through two aspects of ecosystem and wood utilization. The energy required to process wood products is much less than the energy required to complete iron, aluminum, cement, plastics, and other similar products. By revitalizing the long-term utilization of wood, we can reduce fossil energy consumption and ease the release of CO₂. It can be said that expanding the use of long-term timber is killing two birds with one stone. For the vegetation, the afforestation - long-term use - reforestation model should be adopted; for secondary forests, the cutting years should be prolonged as far as possible, and efforts should be made to restore them to stand with high value and large volume, and only high-

value timber should be harvested (Nogherotto, Coppola et al. 2013, Ndehedehe, Okwuashi et al. 2018).

In this way, the CO₂ concentration in the atmosphere can be effectively suppressed through forest production and operation. Therefore, natural regeneration and artificial regeneration technology should be improved to achieve long-term utilization of wood.

3.3 Adoption of Sustainable Fuel for Fossil Fuels

Bioenergy (biomass) is the current replacement for petroleum, natural gas and other fossil energy, the replacement seeks to address the energy gap so that the corresponding fossil energy can be preserved and not released into the atmosphere in the form of CO₂. Bio-energy burning releases CO₂, unlike solar and wind power. Some might argue that it will not replace fossil fuels but using bioenergy like burning wood, is only part of the carbon cycle within an ecosystem, and does not increase the concentration of CO₂ in the system. When a forest is cut or burned, it releases a lot of CO₂, which does increase the concentration of CO₂ in a short period of time. However, in the long run, the forests harvested or burned have been regenerated through forest regeneration to restore the reserves of the original harvested forests, and then the CO₂ previously released will be re-absorbed (Mizoguchi, Miyata et al. 2009, Maksimowicz 2018). Therefore, the continuous production of bioenergy will not increase the concentration of CO₂ in the atmosphere. Contrary to this process, burning utilizes fossil fuels that are not available in the existing ecosystems and emits CO₂ continuously, which will inevitably lead to a continuous increase in atmospheric CO₂ concentration. By using biofuels such as wood, and using them as long as possible, the increased CO₂ in the system can be offset and the increase in atmospheric CO₂ can be suppressed. Above, the countermeasures to reduce CO₂ through the forest were discussed from three aspects, and there was a close relationship between them. Only good forest protection can make good use of forests and obtain the best way to replace fossil fuels. Therefore, CO₂ reduction strategies through forests can be divided into two aspects: protecting forests to promote carbon storage capacity and controlling the use of fossil fuels, and the relationship between these two aspects is mutually reinforcing and inseparable (Baptiste, Christian et al. 2018).

4.0 Economic Land Use and Forest Reservation.

Carbon packing within the soil will be reduced by artificially changing the natural vegetation types. Therefore, it is very important to give full play to the carbon sequestration of organisms in accordance with local conditions when making the necessary regional land use planning. It is necessary to raise the awareness of (Matthews, Nabuurs et al. 1996, Maksimowicz 2018) at the national level and international level. Agricultural land is necessary for grain production. It is important to maintain soil carbon and increase biological productivity per unit area by improving agricultural technology. At the same time, it is also important to prevent the decrease of forest land due to the increase of agricultural land. Relative surplus agricultural land generated by improved agricultural technology returned to forests is very beneficial to carbon storage. Grazing land is the same, through reasonable management, improve the yield of pasture, so that the remaining pasture returned to the original vegetation. For peat swamps and wetlands in forest areas, Sub-Saharan countries used to dig ditches to drain trees for afforestation. As a result, the decomposition of organic carbon in soil was accelerated and CO₂ emissions were increased. The final afforestation did not succeed because they were not suitable for the healthy growth of trees. Therefore, for sites with special site conditions such as swamps and wetlands, it is better to protect them from human disturbance, because they have an excellent regulatory effect on the natural environment. Forest has a variety of functions, which can be directly used as energy, building and furniture materials, paper making, but also play a role in protecting biodiversity and soil and water conservation and carbon sequestration and storage. To protect the biodiversity of forests, we must protect a variety of forest types. Natural forests with small anthropogenic activities have a high carbon content in soil and strong storage capacity for carbon. Priority should be given to the protection of natural vegetation, such as forests, in the formulation of land use plans, so as to achieve the protection of water and soil resources, that is, to protect the carbon storage. Forests with timber production as the main purpose are generally well-operated areas with relatively concentrated plantations. The carbon sequestration ability of the plantation is not bad, but it is not as good as the natural forest if it is related to the protection of biodiversity. Therefore, the natural forest should be preserved properly while planting the plantation, and the watershed where the natural forest has been lost should be gradually restored. Fuelwood forest or pulpwood forest, generally about 20 years of short-cut period, so should be selected in gentle slope or flat land. The use of surplus agricultural land is more suitable. These areas are more convenient than the residential areas. In densely populated cities, suburbs and urban parks, due consideration should be given to ensuring the green space area around the city and the city in land use. Together, these scattered green spaces are enormous in size and quantity and are important for carbon storage. In addition, because of the afforestation of trees can provide shelter for homes and offices, indirectly play a saving air conditioning energy effect (Baptiste, Christian et al. 2018, Hamilton and Friess 2018)

5.0 Ascribes Importance to Bioenergy Development

To reduce fossil energy consumption, the use of bioenergy power generation is a new generation system, however, long-distance power transmission if widely used, which will cause a lot of power consumption. In places like Sweden and Finland, bioenergy has been used to generate electricity, and even the heat generated in the process of generating electricity is not wasted, but for heating. These countries will use flat land as a base for producing bioenergy, which is easy to operate and energy consumption is extremely low. There are many plains and hills in eastern and central and Western China, which have favorable natural conditions for the production and utilization of bioenergy. In particular, the three North Shelterbelt is a good bioenergy feedstock. China's vast forest areas are implementing natural forest protection projects, from the long-term development in the future, forest management and artificial forest thinning will also produce a large number of available bio-energy raw materials. In addition, with the implementation of the policy of returning farmland to forestry in China, the pattern of integration of agriculture and forestry is gradually taking shape. The development of fuelwood forest with broad-leaved tree sprouts as the object in rural areas has a good prospect, which will be conducive to the full play of the role of bioenergy (Thomas, Cameron et al. 2004, Leach 2018).

6.0 Advocates for Sustainable Energy Saving the Ecological Lifestyle

Electricity, natural gas, gasoline, and water, which are essential to our daily lives, are closely related to the occurrence of CO₂. Power generation to burn coal or natural gas, automobile operation consumes gasoline, water purification consumes electricity and so on, it can be said that CO₂ emissions have been integrated into people's lives. People unconsciously consume these energies directly or indirectly, but excessive consumption not only causes unnecessary waste of household expenditure but also accelerates the process of global warming. All the products used in our daily life not only consume energy in the manufacturing process but also consume energy and emit CO₂ in the process of circulation and waste treatment. According to statistics, about 47.5% of all CO₂ emitted into the atmosphere in Japan is emitted by households. So if every household saves energy as much as possible without affecting the quality of life and establishes a new ecological lifestyle, it will play an important role in curbing CO₂ emissions and preventing global warming. It is estimated that a car's engine will produce 39 kg less CO₂ into the atmosphere every year if it reduces idling by five minutes a day, and an air conditioner will produce 31 kg less CO₂ into the atmosphere each year if it sets the temperature up by 1 degree Celsius in summer and 1 degree Celsius in winter. At the initiative of the Ministry of Environment, Japan launched the declaration of 1 million citizens consciously fulfilling their ecological lifestyle, which includes: 1) taking shopping belts with them when shopping in markets and shops, and not using the shopping plastic substitutes provided by merchants. 2) beverage bottles, cans, plastic, and foam plastics should be classified and put into place for easy recycling. 3) the air conditioning temperature is set at 28 degrees Celsius in summer and below 20 degrees Celsius in winter. 4) lighting and electrical equipment should be used as follow, and the main power switch should be cut off when not in use. 5) when shopping nearby, people who can walk or ride bicycles do not use cars. Use public transport as much as possible during the holidays. 6) turn off the car engine when waiting for people or loading and unloading goods. 7) do not use elevators when living below 3 floors. 8) wash your face and brush your teeth at any time, always turn off the faucet and save water as much as possible. 9) the temperature of the washing water in winter is set in cool and moderate heat. 10) purchase daily consumption items with environmental labels. 11) do not waste food and bring ecological awareness to the kitchen. 12) set up the family environmental protection manual, and constantly sum up the experience of ecological life. The concrete content of the ecological lifestyle is not invariable but can be increased according to the individual actual situation. As long as we develop the awareness and consciousness of ecological life, its contents will be very rich. The ecological lifestyle needs the attention of the whole society. Only by acting together can we have greater significance. Advocate in daily life: do not buy unwanted items, buy items to be used for a long time, still have the value of old goods, to implement low-cost transfer or gratuitous dedication to the people in need, and so on, will reduce the generation of waste garbage, to reduce CO₂ emissions play a positive role.

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