Sources and sinks of carbon dioxide environmental sciences essay

Science, Chemistry

CO2 is without doubt the best-known anthropogenetic nursery gas. The increasing degrees of CO2 are of great concern as the universe might confront awful effects in the onset old ages. Figure 3. 1 illustrate the tendency of CO2 in our ambiance and is projected to increase farther if we do non seek to take down it. This curve is known as the Keeling record.

Figure 3. 1: The Keeling curve (Robert Simmon, 2008)

The atmospheric concentration of CO2 is now 390 parts per million (ppm) of CO2 and is lifting at a rate of 2 ppm yearly. This changeless rise in CO2 degree is nevertheless insecure for little island provinces like Mauritius. Mauritius is a little island developing province (SIDS) and is likely to be susceptible to climatic unpredictability and long-run clime alteration chiefly utmost conditions conditions such as cyclone, inundations, drouth and low-lying rise.

Carbon rhythm theoretical account for Mauritius

Mauritius is situated in the Indian Ocean of geographic location of 20A°S and 57A°E and represents the southern portion of the Mascarene Plateau. The Mauritius Island is of volcanic beginning and is composed of olive basalt and doleritic basalt (Nayak, 2005) . It has an country of 1864 km2, surrounded by coral reefs and it has an sole economic zone (EEZ) of 1. 9 km2. The length of the coastline is about 322 kilometers, bordered by coral reefs and enveloping a laguna of 242 km2 (MOE & A ; NDU, 2007) . Bing a little SIDS, Mauritius is greatly reliant on coastal ecosystem for touristry industry.

The extraction of 500, 000 metric tons of coral laguna yearly by traditional methods has been damaging the ocean floor and therefore changing the seabed geometry. This change let bigger moving ridge to make the shore doing extended beach eroding (T. Ramessur, neodymium) . Fortunately a prohibition was inflicted on extraction of depth Marine deposits and is no longer legal. Mauritius has experienced an one-year economic growing of 5-6 % with a rise in criterion of life, together with a growing of energy demand (UNDP, 2008) . Having no modesty of dodo fuel, coal and natural gas, Mauritius is to a great extent dependent on imported goods to run its delicate economic system.

The Mauritius Carbon rhythm is a mostly biological and the remainder consist of anthropogenetic beginnings and sink. Figure 3. 2 illustrate the C rhythm adapted for the Mauritius context

Figure 3. 2: Mauritius C rhythm adapted from NASA EarthScienceEnterprise (Earth Observatory, 2007) Degree centigrade: UsersHansDesktopC cycle. jpg

Carbon exists in the inanimateenvironmentchiefly as:

CO2 in the ambiance and dissolved in H2O and ocean

Limestone and coral

Dead organic affair

Carbon enters universe by the action of autophyte:

Chiefly photoautotrophs like workss and algae. They carry out photosynthesis by utilizing energy from the sunshine, CO2 and H2O for their cellular maps such as biogenesis and respiration.

To a little extent from chemoautotrophs like bacteriums. They obtain their C derived from organic compounds but obtain energy from the oxidization of their substrate.

Carbon returns to the ambiance by:

Respiration

Combustion

Decomposition

In order to to the full understand the Mauritius C rhythm, we need to place the natural beginnings, the anthropogenetic beginnings and the sinks of CO2.

Natural Beginnings

Respiration

Respiration is a normal metabolic procedure. It occurs both on land and in the sea and is a critical component for the C rhythm. Worlds, animate being, bacteriums and fungi green goods CO2 as portion of their normal respiration procedure. Mauritius, being a little island has an estimated population of about 1. 3 million. Our part to atmospheric CO2 due to respiration is comparatively undistinguished. But nevertheless as temperature additions,

the rate of respiration additions and hence farther bring oning CO2 in the ambiance. It is estimated about 60 billion of metric tons of C per twelvemonth (Pg C/yr) is emitted as a consequence of autophytic respiration. Similarly about 55Pg C/ year are evolved as a consequence of heterotrophic respiration (Reay and Grace, 2007) .

Vulcanism and biomass combustion

During a volcanic activity, a big sum of CO2 and aerosol are released to the ambiance. Sometimes it is on a big graduated table but is comparatively minor on a planetary graduated table and it amounts about 0. 02 - 0. 05 one million millions of metric tons of C per twelvemonth (Pg C/yr) (Reay and Grace, 2007) .

Fires caused by lightning work stoppages have accounted and still do history for some big biomass firing event - therefore emanation of CO2. However this impact of atmospheric CO2 is comparatively short term because of the consumption of CO2 of flora regrowth.

In the Mauritius context, there are no recorded volcanic activities and natural fires. But what if Mauritius was affected by them?

If Mauritius had active vents, a batch of CO2 accompanied with other gases would hold been released to the ambiance. Volcanic gas is a important agent to planetary alteration. This would consequences into terrible effects on the lives of people and every bit good as the environment. A batch of tellurian flora and alien wood would hold been destroyed and do a break in the local economic system. If this was so, so volcanism would hold history for being

among the chief beginning of CO2 in Mauritius. Figure 3. 3 illustrates an illustration of volcanic activity adapted for Mauritius.

Note: refer to Annex 1 for a elaborate account of the volcanic activity.

Mauritius has a limited forest country of 22, 519 hour angle being state-owned and 25, 000 hour angle being privately-owned (CSO, 2007) . These forest countries were nevertheless greatly affected by human colony and industrialization over old ages. They represent the most of import sink for CO2 in Mauritius - a natural storage country - for CO2 by hive awaying it for photosynthetic activities. If these woods were affected by natural fires, it would let go of 100s of old ages deserving stored CO2 into the ambiance in a affair of hours. Burning of forest would besides let go of a big sum of particulates and gases including GHG. Furthermore firing would for good destruct the most of import sink for CO2 if it is non replaced.

Anthropogenetic beginnings

Land-use alteration

Land-use and land usage alterations straight affect the exchange of GHG between the Earth ecosystem and the ambiance. It is estimated to lend 10-30 % of all current anthropogenetic CO2 emanation (Reay and Grace, 2007) . As land is converted to agricultural land, there is an addition in CO2 emanation associated with land usage due to the followers:

Soil perturbation.

Increased rate of decomposition in born-again dirt.

Increased dirt eroding and bleeding dirt foods further cut downing the potency for the country to move as a sink for atmospheric C.

Mauritius is a dumbly populated SIDS. It has limited high quality country which amounts to 185 000 hour angle which is suited for effectual development. In line with that, it is one of the agricultural islands holding 16 % built-up infinite and turning at a gait of 100 hour angle of residential infinite per twelvemonth. The agricultural country occupied a infinite of 80 674 hour angle and out of this proportion 68 523 hour angle of the entire land country is occupied by sugar cane. Other important land usage include wood and bush which is estimated to be 47 200 hour angle and built development including roads and public-service corporations amount to 46 500 (CSO, 2007) .

The land usage has complex effects on the environment in a state like Mauritius whereagribusinessis limited to monoculture that is sugarcane. Preharvest cane combustion is a signifier if harvest direction frequently patterns in Mauritius frequently as a agency for uncluttering intents and this consequence into a big sum of gases being evolved into the ambiance. But it is non in misdemeanor of the Kyoto Protocol. Bush combustion is besides considered as an activity that release GHG to the environment. Forest fires incidents and combustion of agricultural residues are excessively fringy to be considered as they represent less than 1 % of the entire wood burned. Figure 3. 4 illustrates the alterations made in forested land from twelvemonth 1998 to 2007. The forestland takes into history for both state-owned and privately-owned. This lessening is due to human colony and industrialization.

The rapid industrialization and urbanization during the past decennaries have led to altering production and production forms that continue to show new demands for natural beginning and make new waste watercourse. Solid waste aggregation is disposed merely at Mare Chicose landfill via a web of transportation Stationss. Landfill gases consist chiefly of 40-60 % of the methane and with the balance being largely CO2. There are besides some hints of N, O and H2O vapor.

It is estimated that approximately 380 000 metric tons of waste is produced in Mauritius yearly and is expected to make 410 000 metric tons by 2014. The Mare Chicose was originally designed to have 400 metric tons and is now having 1000 metric tons of waste. Figure 3. 5 illustrate the annually solid waste input at Mare Chicose.

Energy-related emanation

Mauritius being a SIDS has a heavy trust on imported dodo fuel to run its economic system and hence doing it vulnerable to alterations in fuel monetary values. The chief dodo fuels that are imported are: coal, gasolene, diesel oil, double intent kerosine, fuel oil and LPG. The CO2 emanation associated with fossil fuel burning sums to 2454 Gg in 2000 and 3485. 8 Gg in 2008 (CSO, 2009) stand foring an addition of 1. 1 % . Figure 3. 7 illustrate the tendency of CO2 emanation from fossil fuel burning activities.

Figure 3. 7: CO2 emission/Gg from fuel burning activities (Computed, Data from CSO, 2008)

The electricity sector in Mauritius histories for more than 50 % of the CO2 emanation (UNDP, 2006) . The electricity coevals is governed by Central

Electricity Board (CEB) and Independent Power Producers (IPP) . Fuel input increased by 6. 2 % from 707 ktoe in 2007 to 751 ktoe in 2008 (Ministry of Renewable energy & A ; Public Utilities, 2009) . Coal is the dominant fuel followed by bagasse and fuel oil. Their tendencies are illustrated in the figure 3. 8.

The fabrication industry is one of the chief pillars of Mauritius and is the 3rd greatest CO2 emitter. There were about 807 fabrication constitutions in 2007 (MOE & A ; UNEP, 2008) . In industrial companies every bit good as industry sector specific informations onpollutionand resource usage are non methodically collected and published in Mauritius. The absences of these dependable informations block the effectual environmental direction in industry. The chief types of fuel input for fabrication industry are: fuel oil, Diesel oil, LPG, coal, fuelwood, bagasse and electricity. The concluding energy ingestion by the fabrication sector is illustrated in figure 3. 9.

Conveyance

Conveyance is one of the critical pillars of the Mauritanian economic system and the 2nd greatest CO2 emitter. It goes without stating that conveyance has a heavy dependance on fossil fuel. The mean one-year growing of vehicular fleet is of approximately 5 % . The entire figure of vehicles has drastically increase from 233, 415 in 1999 to 351, 406 in 2008 as illustrated in figure 3. 10. Figure 3. 11 shows the rise in figure of vehicles per kilometer of route from 2003 to 2008.

This rapid addition in vehicles consequences into an addition in gasolene and Diesel oil imports. Unleaded gasolene is available as from November 2002 on the local market. But harmonizing to auto traders the per centum of vehicles holding a on the job catalytic convertor is negligible (MOE & A ; UDP, neodymium) . It is hard to gauge the sum of gasolene used by 4-stroke and 2-stroke engines for conveyance. It has been hence decided that 90 % of the imported gasolene is for 4-stroke engine (MOE & A ; UDU, neodymium) . But since a few old ages now, some autos are equipped with engines capable to run liquefied crude oil gas (LPG) . Figure 3. 12 illustrate the CO2 emanation from use of gasoline, diesel oil and LPG. As deduced, the entire CO2 degree is on the rise.

Air conveyance is still to a great extent dependent on imported dodo fuel as illustrated by the tendency line in figure 3. 14.

Sinks

Ocean

The oceans play a main portion in both the organic and inorganic parts of the C rhythm. CO2 diffuses readily in H2O and ocean and supply a reservoir of C. Figure 3. 15 illustrate the pelagic C rhythm adapted for the context of Mauritius. It is believed that the ocean absorb more than 30 % of human CO2 emanation since industrial revolution (Lee et al. , 2003) . Therefore it is the 2nd largest CO2 sink after the ambiance and history for merely half of the planetary biological C consumption. (Field et al., 1998) .

Mauritius is at a important phase in its socio-economic development development. The sustainability of its marine resources and preservation of its exceeding diverseness depends on a critical apprehension of the linkage between human activities and the ecological responses (Ramessur, neodymium) . Mauritius has declared its territorial sea of 12 maritime stat mis (nanometer) through the territorial sea Act of 16 April 1970 and its sole economic zone of 200 nanometer around the island of Mauritius, Rodrigues, Agalega, Cargados Carajos shoals, Chagos Archipelagos and Tromelin as illustrated in figure 4. 16.

The British Indian Ocean Territory (BIOT) is an abroad district of the United Kingdom (UK) . The UK is committed to strong environmental protection. The district covers a big country of reefs and islands known as Chagos Archipelago and consists of some 50 islands and islets with a entire land country of 60 square kilometers. It has a high faunal diverseness and has alone type of coral. Some of its countries were affected by coral decoloring events in 1998 but there was no record of the bleaching strength. Coral loss is estimated to be 80-85 % on seawards and some countries were close to 100 % . The Chagos Archipelagos is intensely threatened by environmental alterations such as direct clime alteration impact, ocean acidification and sea degree rise.

Vegetation

Plants are of import sinks for the atmospheric CO2 on both land and in aquatic environment. They utilize CO2 during photosynthesis and besides

produce it during respiration. Some of this C is transferred to the dirt as workss die and decompose.

Mauritius has been colonized in the center of the sixteenth century by the Dutch, French and British severally. The three periods of colonisation have been marked by the terribledeforestationto do manner for agricultural development, infrastructural development, lodging estates, route, dams etc. But by the terminal of the sixteenth century, most of the native wood has disappeared with the exclusion of a few scattered pockets of native flora which has been spared because of their farness.

Mauritius is an agricultural island busying a infinite of 80 674 hour angle and out of this proportion 65 500 hectares of the entire land is occupied by sugar cane (CSO, 2009) . It has an country of 2000 km2 of which 30 % is considered forested (United Nations Forum on Forests, 2004) as illustrated in figure 3. 17. Mauritius chief hard currency harvest is sugarcane. It has been recognized that without sugar cane plantations which both bind the dirt and act as CO2 sink, our dirts would degrade really fast, the lagunas would slice up and air quality would degrade with hostile consequence on touristry and fishing. Sugarcane has one of the most efficient photosynthetic mechanisms among commercial harvests. It helps in repairing 2-3 % of the radiant solar energy and transportations it into green biomass. This high photosynthetic capableness besides allows it to demo a high coefficient of CO2 arrested development, comparable to the moderate zone forests and therefore lending to the decrease of nursery consequence (O. Almazan and al. , 1998) .

Bing a little island developing province, Mauritius has many physical restraints similar to other islands. The woods of Mauritius are little in country but carry out important maps, the most of import of them being dirt, H2O preservation, C segregation and in the preservation of biodiversity and wildlife.

Soil plays a cardinal function in the Mauritanian C rhythm. The decomposition of some of the C in the dirt is respired by break uping being and C is returned to the ambiance as CO2. The remainder of the modified dirt decompose at a slower gait and therefore locked the C from the ambiance.

However the state is known for its delicate ecosystem and endured loss of biodiversity in the yesteryear. There is besides an addition demand of land for lodging to suit the turning population accompanied with a rise in criterion of life. Therefore this consequences into a loss of forest countries and tree screen.