EVALUATING THE CARBON DIOXIDE SEQUESTRATION IN THE TREES IN THE TEMPERATE AND TROPICAL REGION (work in progress)
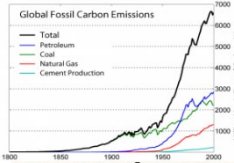
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Introduction

Research Objectives

Categorising Sources of CO_2 emission in the UK.

Studying and analysing the 3 major methods and nearly 80 technologies at different stages of development for CO_2 capture were investigated.

Studying the dynamism of CO_2 sequestration in the trees & its potential to mitigate climate change in support of UNDP-Goal 13.

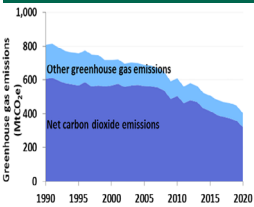Gathering and analyzing tree morphological data from previous literature.

Developing a novel mathematical model as a basis for estimation of CO_2 sequestration in the selected tree species at any climatic region.

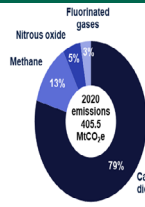Gathering of weather data to validate the model
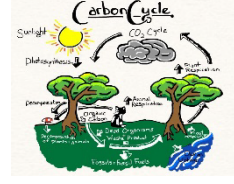
Literature Review

Assessment of GHGs emission from various sectors in the UK.

S/N	Action	potential Reduction (tCO₂eq/cap)
1	Car-free live	2.040
2	Electric vehicle	1.950
3	reduced long-haul flight	1.680
4	Renewable electricity	1.600
5	Public transport	0.980
6	Refurbishment & renovation	0.895
7	Vegan diet	0.800
8	Heat pump	0.795
9	improved cooking equipment	0.650
10	Renewable-based heating	0.640
11	Decommissioning of Coal-Powered stations	40% in 2010 to1.8% in 2020

Reduction Strategies of carbon footprint in the UK

Assessment of CCS Methods and Separation Technologies

Elevated energy consumption and high cost

The selected route for carbon sequestration & the hypothesis

The concept of artificial trees/forest

The entire world known tree species 60,065, by Evans Erv in 2018.

Endemic trees – indigenous & prevalent

Focus on CO_2 absorption per time to address today's need.

The preliminary result of my findings shows that 29.5 km² Forest in the tropical sequester 6279.5 tonne/yr. Very alarming!!! About 6.6 of UK landmass needed.

UK emission in 2020 is 320.35MtCO₂/yr. < 340MtCO₂/yr. in 2019 < as against 373.4MtCO₂ in 2017. Thus, 0.877MtCO₂/day

Model Development and Preliminary Results

$$M_{CO2(absorbed)}=\frac{(I*L.A*M_{mm}CO_2)}{60*E_{photon}}$$

$$E = hc/\lambda$$

$$I = S\cos Z$$

$$Z = \cos^{-1}(\sin X \sin Y + \cos X \cos Y \cos H).$$

Description of Location on the Globe

X: latitude angle

Y: solar declination angle

H: the hour angle

S: solar constant -- around 1000 W/m^2

Z: zenith angle from the equation above

Sunrise = $12 - (1\!\!15° \cos^{-1}(-\sin\varphi \sin\delta /\cos\varphi \cos\delta))$

Sunset = $12+(1/15° \cos^{-1}(-\sin\varphi \sin\delta /\cos\varphi \cos\delta))$

[1]There are 60,065 species of trees globally & only 44 endemic species to the UK.

Simplified approach for CO_2 Estimation

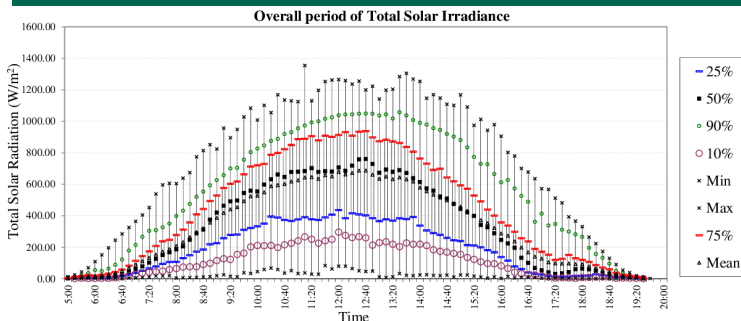Estimate the total green mass → Estimate the dry mass of the tree → Estimate the mass of the C sequestered in the tree → Estimate the mass CO_2 sequestered in the tree/time → Estimated CO_2 sequestered by a tree per year

Application of CITYgreen Model`& Allometric Equation

Mobile Laser Scanning (MLS) data and i-Tree Eco Model

Data Collection and Analysis

[2]Hourly profile of Total Solar Irradiance reaching the surface of the ponds

Importance of the Research

Support the measurement of forest efficiency and productivity for climate action

To support ecosystem service planning and management

References

1. Beech, et al., 2017GlobalTreeSearch: The first complete global database of tree species and country distributions

2. Dias, D.F., & von Sperling, M. (2017). Solar radiation (PAR, UV-A, UV-B) penetration in a shallow maturation pond operating in a tropical climate.

3. Office of National Statistics ONS, 2020;

4. The World Bank IBRD-IDA, 2015

5. (Department of Business, Energy & Industrial Strategy, 2019); Welch 2019; Toochi 2018)

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