Proposal for Carbon Flux Measurement
Yaseen AL-Tai, #213996921

Objective:

The purpose of the proposal is to provide Jimmie Peatly a carbon fluxesproportion associated with each crop typeby using scientific measurements. Our techniciansdepend ona particular mechanism to obtain an accurate ratio of carbon footprint in the four areas. The time-period takes about one year to get the full data toknow if these crops are carbon offset or carbon credit.

Introduction:

Man-made climate change, or global warming, is caused by the release of certain types of gas into the atmosphere. The dominant man-made greenhouse gas is carbon dioxide (CO_2), which is emitting whenever we burn fossil fuels in homes, factories or power stations.***(Berners-Lee, 2011).*** On the other hand, rising atmospheric (CO_2) concentrations lead to more numerous and more robust plants, which yearly remove ever-greater quantities of CO_2-derived carbon from the atmosphere, storing it initially in their own tissues, eventually in the soil, and ultimately in the depths of the sea**(The Many Benefits of Atmospheric CO2 Enrichment, 2011).**As we see in *Figure 1*, Canada's total greenhouse gas (GHG) emissions in 2014 were 732 megatonnes (Mt) of carbon dioxide equivalent (CO_2 eq), or 20% (120 Mt CO_2 eq) above the 1990 emissions of (613 Mt CO_2 eq). Farming emits all three GHGs: carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N20). These gasses differ, though, in their ability to trap heat; ton for ton, (CH_4) is more than 20 times as efficient at trapping heat as (CO_2), and (N_2O) is about 300 times as effective as (CO_2) ***(Environment and Climate Change Canada, 2016).***

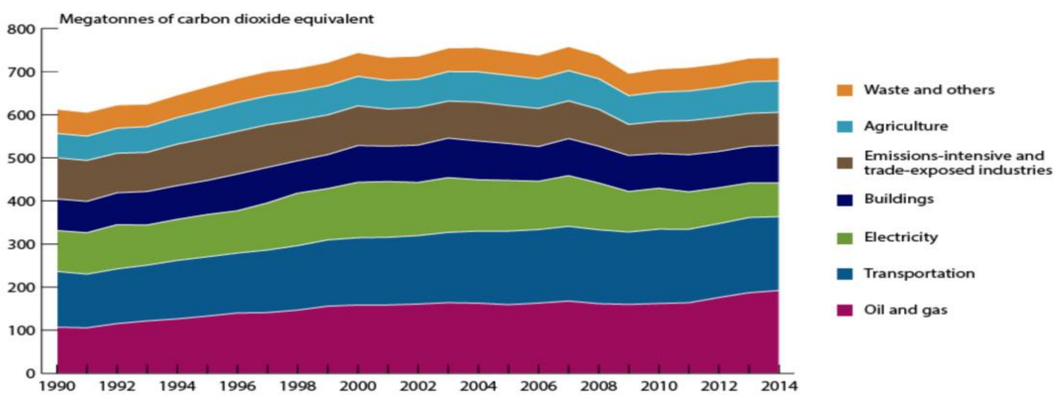

Figure 1. **Greenhouse gas emissions by economic sector, Canada, 1990 to 2014*(Environment and Climate Change Canada, 2016).***

Methods:

It is a problematic issue to estimate GHG emissions from cropping practices because of alterations in: soil moisture, soil temperature, cropping systems, geographic location and soil properties. Which makes it challenging to estimate total GHG emissions for a particular area.But the 20 technicians using an advanced system, which depends on the measurement of metrological variables, observing system and management of the observing system.The First method is setting up towers (FLUXNET) in each area; the main aim of these towers is to quantify the variations of carbon dioxide fluxes due to changes intemperature, soil moisture, photosynthetic capacity, nutrition, canopy structure, and length of growing season ***(Running et al. 1999).***The carbon dioxide in a crop canopy is transported in a vertical direction with various sized eddies that exist in the atmosphere above the canopy. The micrometeorological technique measures the movement of these eddies and the fluctuations in carbon dioxide concentration and then measures the speed of carbon dioxide absorption and release ***(Eddy covariance flux, 2016).***

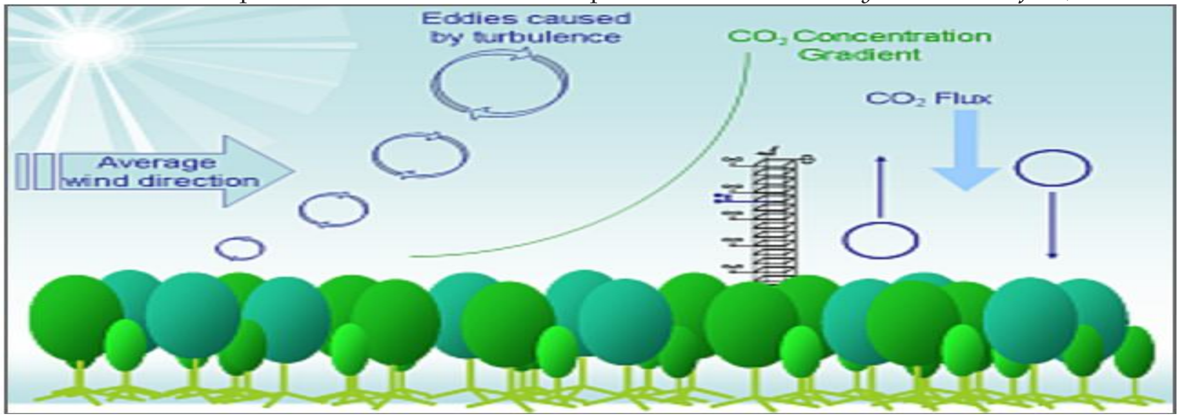

Figure 2. Carbon dioxide flux measurement with the Eddy covariance method***(Eddy covariance flux measurements, 2016)***

After obtaining the data, FLUXNET has two operational components, a project office and a data archive office. The project office includes organizing workshops for data synthesis and model testing activities and providing scientific guidance to the FLUXNET data and information system whereas the data archive office is responsible for compiling and documenting data in consistent formats and scrutinizing datasets with standard quality control and assurance procedures ***(Running et al. 1999).***The second method is to build anautomatic station capable of measuring carbon flux. This station includes two pieces of measurements (Satellite observations and Balloon techniques). The primary goal of the satellite observations is to analyze the proportion of (CO2, CH4, and N2O) of the four areas by knowing the radiations concentration. While balloon techniqueconsiders as a novel method of measuring the exchange of carbon dioxide over croplands using a high-altitude balloon (HAB) platform. TheHAB methodology measures two sequential vertical profiles of carbon dioxide concentration, and using a mass-balance approach it calculates the surface exchange by difference and application of the ideal gas law***(Bouche et al, 2016). Figure 3*** shows the design of the balloon**.**

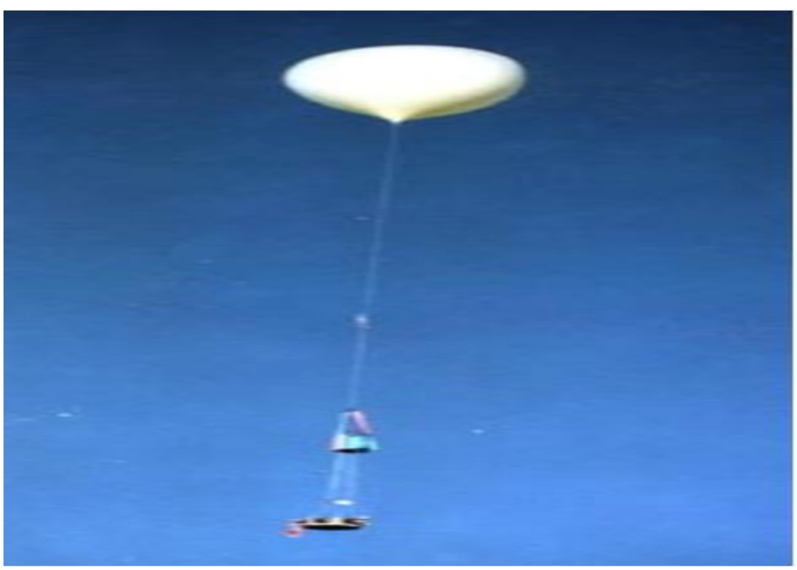

Figure 3. Generally attaining between 60,000 to 120,000 ft. (11 to 23 mi; 18 to 37 km) ***(Institute of Space and Astronautical Science, 2011).***

At the end of the day, all the data that comes from both balloon and satellite goes directly to the station to analyze and study it. After that, the specialist should compare between the simulations and the experiments to obtain an accurate measurement of the GHGs across the four areas. Some of the confidential data of this research can published in a journal like Atmosphere-Ocean, published by the Canadian Meteorological and Oceanic Society. But first, a journal editor should review the report more than one time and then could be issued to the journal. ***Figure 4*** shows the process to publish the data, which it goes through 5 steps or more.

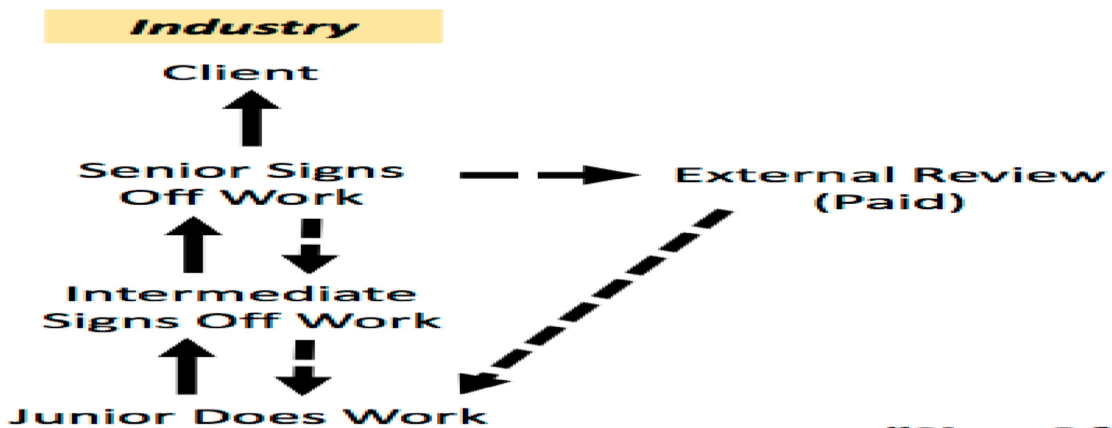

Figure 4.Publishing methods

Budget:

Budget Type	Project Cost $/Month	Project Financial $/Month From Mar 2016 to Mar 2017
	Salaries	
Junior (Available)	**$9,600**	**$115,200**
Intermediate (Limited availability)	**$3,840**	**$46,080**
Senior (Available)	**$38,400**	**$460,800**
Travel (Commuting by a small Car)	$1,000	$12,000
Equipment (Computers, measurements and components to build the station + 1% purchase cost per day)	$5,000	$60,000
Overhead (Insurance, rent, and interest + 17% applied to direct cost)	$2,000	$24,000
Total	$59,840	$$718,080 + $1,000 for publishing the research in the journal

Table 1: Budget of the salaries, travel, equipment, overhead and the total.

Project Schedule:

	MAR	APR	MAY	JUN	JUL	AGU	SEP	OCT	NOV	DEC	JAN	FAB	MAR
Field Observations: • Field notes	A, B, C	A, C	A	A, B	A, C	A	A	A, C	A, B	A, B, C	A	A, B	A, B, C
• Seating Charts	A, B, C	A	A, B	A, B, C	B, C	A, B	B, C	A, B	A, C	A, B, C	A	A	A, B, C
Implementation: • Set up computers	A, B, C		A, C							A, B, C			A, B, C
• Set up Towers + maintenance	A, B, C												A, B, C
• Set up station + maintenance	A, B, C									A, B, C			A, B, C
Data Analysis: • Study the data		A, B	A,C	A, C	A, C	A, B	A	A	A	A, B, C	A, B	A	A, B, C
• Detection of mistakes										A, B, C	A, B, C	A, B, C	A, B, C
• Checking of assumption										A, B, C	A, B, C	A, B, C	A, B, C

Table 2: Demonstrates the work schedule throughout the year.

{Junior: A/ Intimidate: B/ Senior: C}

Work Packages:

1) **Field Observations**: Is the collection of information outside a laboratory. For example, measure the amount of CO_2

2) **Implementation**: Set up the towers, stations, and the computers to collect sample and data. For example, capturing an image of the CO_2 concentration over the land by using satellites.

3**) Data Analysis**: Is a process of inspecting, cleaning, transforming, and modeling data with the goal of discovering useful information, suggesting conclusions, and supporting decision-making.

References:

1) Berners-Lee, M. (2011). How bad are bananas?: The carbon footprint of everything. Vancouver: Greystone Books.

2) Environment and Climate Change Canada (2016) National Inventory Report 1990–2014: Greenhouse Gas Sources and Sinks in Canada.

3) Running, S. W., D. D. Baldocchi, D. Turner, S. T. Gower, P. Bakwin, and K. Hibbard, 1999: A global terrestrial moni- toring network, scaling tower fluxes with ecosystem model- ing and EOS satellite data. Remote Sens. Environ., 70, 108– 127.

4) Summary of Our Observation. (n.d.). Retrieved June 23, 2016, from http://www2.ffpri.affrc.go.jp/labs/flux/observation_e.html

5) "Research on Balloon to Float over 50km Altitude". Institute of Space and Astronautical Science, JAXA. Retrieved 2011-09-29.

6) Bouche, A., Beck-Winchatz, B., and Potosnak, M. J.: A high-altitude balloon platform for determining exchange of carbon dioxide over agricultural landscapes, Atmos. Meas. Tech. Discuss., doi:10.5194/amt-2016-91, in review, 2016.

7)The Many Benefits of Atmospheric CO2 Enrichment. (n.d.). Retrieved from http://www.ucsusa.org/sites/default/files/legacy/assets/documents/global_warming/Global-Warming-Skeptic-Organizations-Source-15-ALEC.pdf