CALIFORNIA STATE SCIENCE FAIR
2012 PROJECT SUMMARY

Name(s)
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Project Number
J1008

Project Title
Carbon Sequestration in Farming: Can an 80 Acre Farm be Carbon Neutral?

Abstract

Objectives/Goals
The objective was to see if an 80 acre farm could be farmed carbon neutral.

Methods/Materials
Building on last year's Science Fair Project "Is There an Optimal Cover Crop Density for Carbon Sequestration in Vineyards?", an experiment was designed to verify the carbon content of what I believed would be the major carbon absorption element; the cover crops and grassland. Fifty samples of cover crop and grassland growth were measured, harvested, dehydrated and weighed. The average carbon content was calculated using the average sample weights in three representative areas of: 1) newly tilled and planted cover crop, 2) untilled/unplanted cover crop regrowth and 3) open perennial grassland. Sample grapevines and trees were also harvested, dehydrated and weighed. Because it is impractical and wouldn't be right to cut multiple samples of trees and vines, I devised an experiment to measure the average trunk dimensions and dig up a single representative sample of a diseased vine and small tree to dehydrate and weigh. A calculation was then performed to account for all carbon absorbing elements within the fenced 80 acres. The results were tabulated to estimate the total annual carbon sequestration in metric tonnes per acre. An estimate of annual carbon emissions was prepared using actual data of electricity, gas and fuel consumption and animal/people load on the farm. These variables were plugged into a web-based greenhouse gas auditing tool, CPLAN, available from cplan.org using the standards and equations agreed at the Intergovernmental Panel on Climate Change (IPCC) in 2006. For the larger trees and forested areas I used the US Department of Agriculture Carbon Calculation Tool (CCT).

Results
The results showed that 49.8 metric tons of carbon were produced on the farm last year with the single greatest emitter, the Bio-Diesel used to power pumps, vehicles and tractors (14.9 tonnes). During the same period, the farm sequestered over 139.8 tonnes with over half (69 tonnes) of the carbon absorption coming from cover crops and grasslands within the 80 acres.

Conclusions/Discussion
The hypothesis is verified: this 80 acre bio-diverse farm can be farmed carbon neutral and, in fact, sequesters almost 3 times as much carbon as it emits.

Summary Statement
An experiment was performed to determine whether or not an 80 acre farm could be farmed carbon neutral.

Help Received
My advisor Mr. Paul Zellman gave me lots of feedback. Jerry Yates helped me dig up and weigh and the grapevine and tree samples. My mother helped me take samples. My father helped me put the data into a spreadsheet.