

# The Effectiveness and Viability of Carbon Sequestration Methods on Farms

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### COLLEGE PARK SCHOLARS

#### Introduction:

Interning for Dr Ning Zeng of Carbon Lockdown, we will be extensively researching and performing physical study of different methods of carbon sequestration on farms, and comparing the carbon sequestration improvement percentage each method gives, along with its difficulty of implementation and upkeep, all this to give suggestions on which methods can be useful in which situation. The methods chosen for analysis and comparison are no-till, which is the practice of tilling as little as possible, typically using herbicides and such as a substitute, and tilling practices, where tractors, hoes, or any other sort of tilling equipment is used to turn the soil around the crops.

#### Soil samples and Materials

-4 samples for baseline/control

-8 for each method used on farm

-Sample should be 50g, and taken from at least 20 inches in the ground.

-For the control, sample must be collected on farm, but not in places where crops are being planted, ie the fields *around* the cropland, not inside of them. -For each method, the samples shall be taken no more than 2 feet away from any sequestering plants of said method. I have a 0.01 accuracy scale

#### Who I am interning for:

I am working under Ning Zeng in the AOSC Department, specifically his Carbon Lockdown project which seeks to introduce wood vaults into the mix of ways to sequester carbon on farms, wood vaulting being the process in which organic matter (trees almost exclusively) are buried underground to sequester carbon. The research I am performing will allow the benefits of wood vaults, when they are introduced, to be visually compared with other methods, but for now, I am just analyzing a few select methods, those being no-till and tilling procedures.

Some collected soil samples.



-Oven to lose excess water

-37% HCl for acid digestion

-HDPE (High-Density Polyethylene) containers to aid

-Comprehensive emails regarding the work done on farm provided, specifically asking to describe the difficulty of implementation for each method and the cost of upkeep.

#### Methodology:

- The method used to measure organic carbon sequestered by natural processes (TOC) was acid digestion
- Soil samples were collected from farms (either by you or farm owners following instructions).

Samples were dried in a 250-degree oven.

- HCl was added to the dried samples in HDPE containers until the weight stabilized. The time for stabilization was used to calculate the Sequestration Change Percentage (SCP) by dividing it by a baseline TOC average, normalizing for natural soil variations. Each sequestration method has a Difficulty (1-10) and Annual Upkeep Cost (\$/acre/year) reported by farmers.
- SCP, Difficulty, and Cost are plotted on 3D graphs (one per method) to compare methods. Lower Difficulty and Cost, and higher SCP (towards a "green circle") indicate better methods.
- Users can weight the importance of factors like "invasiveness" to see their amplified effect on a method's overall ranking on the 3D graphs.

#### Data Analysis:

The results of this research show that while tilling methods are generally less expensive, they require more maintenance and provide less improvement in terms of carbon sequestered than no-till, meaning that generally speaking, no-till is a the optimal option, especially if you have the money at your disposal or if you require a minimally invasive method, but if you dont have the money to implement, tilling Full graph showing the CO2 Sequestration Change Percentage vs Cost of Upkeep and Difficulty of implementation. (filled in dots are no-till, non-filled are till.)



#### Graph showing the CO2 Sequestration Change Percentage vs just Cost of Upkeep. (filled in dots are no-till, non-filled are till.)



Graph showing the CO2 Sequestration Change Percentage vs just Difficulty of Implementation. (filled in dots are no-till, non-filled are till.)



## generally costs less but has the drawbacks of somewhat harming the soil and lowering sequestration. THE RESULTS

4 2 0 1900 2000 2000 Cost of Upkeep (\$)

Difficulty of Implementation

These results show that, while carbon sequestration has a much higher concentration in farm areas that use no-till, as proven by the testing and the inquiry emails, different situations seem to give one method an edge over another. For example, if you were on a small farm that was your only stream of income, you would want a less invasive method to use, so no-till would absolutely be the proper choice. However, if you are on a farm that has generally less money to spend, tilling would maybe make you rethink changing to no-till, but either way, no-till is definitively the more environmentally-friendly option for farms.

## THE FUTURE

For future parts of this massive project, I will use climate prediction modeling to find out which methods are most useful in which locations over the US, as say, solar voltaic is not going to be nearly as useful in a rainy and cloudy place than in an open, bright location. Using this new information and collecting new samples and to add to this graph, I will make a map of areas over the US and the different levels of potential each location has with which method.

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