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The Carbon Sequestration Potential of Regenerative Farming Practices in SC.

Current production agriculture systems are heavily focused on yield outcomes at all costs. By shifting to regenerative farming practices (having a live root in the soil as many days as possible, always having soil covered, reducing tillage, and increasing biodiversity), however, agricultural systems worldwide could maintain or even improve yields while sequestering atmospheric carbon (C) into soil organic matter (SOM), reducing greenhouse gasses and ensuring healthy, fertile soil for future generations. Roughly 37% of the earth's land mass (excluding Antarctica and Greenland) is agricultural land, making agriculture the largest ecosystem on the planet. Monocropping practices of traditional agriculture are inherently low in biodiversity, meaning that the worlds largest ecosystem has restricted biodiversity and will, therefore, eventually exhaust terrestrial resources and continue to rapidly move C from the land to the atmosphere. To demonstrate the effectiveness of regenerative practices at reversing these effects while simultaneously benefiting agriculture, the C sequestration potential of these practices needs to be examined.

SOM data from 491 soil sampling points from various farms throughout the coastal plains of South Carolina were compared over varying multiple-year periods between 2013 and 2017 as they transitioned from conventional to regenerative agricultural practices. 438 of the sites have undergone two years of regenerative practices, 40 sites have undergone three years, and 13 sites have undergone four years. The implementation of multispecies cover crops between cash crop rotations and the reduction or elimination of tillage over this span of time has resulted in statistically significant average increases of 0.09 ($p \leq 0.001$), 0.11 ($p \leq 0.001$), and 0.55 ($p \leq 0.001$) SOM percentage for the two-, three-, and four-year sampling sites, respectively. When averaged out per year for each sampling group, this results in increases of 877, 1,167, and 2,731 lbs of SOM per acre per year, meaning that an average of 509, 677, and 1,584 lbs per acre per year of C sequestered from the atmosphere and deposited into the soil.

The most recent USDA Census of Agriculture (2012) reports the total cropland in SC to be 1,967,288 acres and an average farm size of 197 acres, creating potential atmospheric C sequestration of 50 - 156

tons per year for a single average farm, and 500,647 – 1,558,092 tons statewide if regenerative practices are implemented. Additionally, the rate of C sequestration appears to increase exponentially as the duration of time managed regeneratively increases, but further studies will be necessary to determine if this is real or an effect of environmental factors.

Because the rate of soil atmospheric carbon sequestration is dependent not only on land management practices but also on environmental factors such as soil texture and structure, rainfall, and temperature, there will be variability across the state. The calculations based on the coastal plains soils studied here, however, demonstrate the promising potential of regenerative farming practices to not only restore degraded biodiversity, recycle nutrients, and reduce chemical inputs, but also to sequester atmospheric C and simultaneously help reduce the effect of global climate change while creating healthy soils.