USDA United States Department of Agriculture

Natural Resources Conservation Service

Soil Science Division—Region 9

Southern Great Plains Region

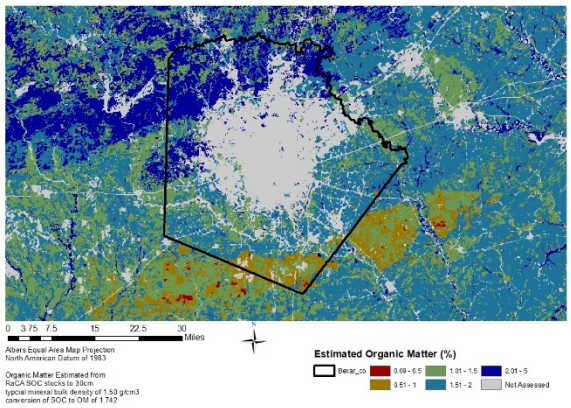
Urban Ecosystem Carbon Management

Purpose

Have you ever heard of urban ecosystem carbon management? If not, you are not alone! On October 9, 2018 soil scientists from TX NRCS and Region 9 Soil Survey, and representatives from San Antonio, TX met to discuss measuring soil carbon in and around the city and the impacts management would have on soil health and water quality, in the city of over 1.4 million people. Attending the meeting were Lissa Martinez, Alamo Area Master Naturalist; Debbie Reid, Aquifer Alliance; Samantha Salinas, NRCS Bexar County District Conservationist; Alan Stahnke, NRCS TX State Soil Scientist; Nathan Haile, NRCS TX Soil Health Specialist; Carlos Villareal, NRCS TX Soil Scientist; and Travis Waiser, NRCS MLRA Leader. Prior to the meeting, Lissa Martinez researched the NRCS Soil Science Division (SSD) Rapid Carbon Assessment (RaCA) study and contacted Skye Wills, Soil Scientist, NSSC, Lincoln, NE, who provided a map from the RaCA project of Bexar County, TX. Travis Waiser, who served as the RaCA co-lead for Region 9 during the field sampling and scanning of soils, explained that because of the highly urbanized areas in and around San Antonio, a large part of Bexar County was not evaluated for soil carbon as highly urbanized areas were outside the scope of the RaCA project.

San Antonio sits above the Edwards Aquifer, one of the main aquifers supplying the city with most of its drinking water. The Edwards Aquifer is known for clean water and is one of the most productive aquifers across the United States[1].

The aquifer is composed of karst limestone leading to quick recharge rates which leads to the importance of protecting recharge areas from contaminates. Official Aquifer Levels and Statistics[2] show the quick recharge rate during rainfall accumulations between August and October 2018, when a well site located in Bexar County was measured at 640.6 feet above sea level (ASL) on August 31, on October 22, 2018 it measured 681.2 feet ASL, an increase of 40.6 feet.



The map shows estimated soil organic matter in Bexar County, TX. Grey areas show heavily urbanized areas not sampled during the RaCa project.

Background Information

The Rapid Carbon Assessment (RaCA)[3] was initiated by the USDA-NRCS Soil Science Division in 2010 with the following objectives:

- To develop statistically reliable quantitative estimates of amounts and distribution of carbon stocks for U.S. soils under various land covers and to the extent possible, differing agricultural management.
- To provide data to support model simulations of soil carbon change related to land use change, agricultural management, conservation practices, and climate change.
- To provide a scientifically and statistically defensible inventory of soil carbon stocks for the U.S.
- To accomplish these objectives, 144,833 samples were collected from the upper 1 meter of 32,084 soil profiles

at 6,017 randomly selected locations for measurement of organic and inorganic carbon by visible and near infrared (VNIR) spectroscopy and bulk density by traditional methods. National Range Inventory (NRI) sites were used as the basis for random selection of sample sites stratified by soil group within RaCA Region and land use/land cover (LULC) within the soil group. Soil morphology and landscape characteristics were described at each site and limited vegetation and agricultural management information was collected from each location. Sample collection and analysis involved more than 300 soil scientists and assistance from 24 universities.

Key Outcomes

Discussions centered around the function of carbon stocks and the role they play in ecosystems; how the RaCA sampling protocol established the baseline of current carbon stocks; and how management strategies developed for urban areas would benefit land usage. Soil carbon and organic matter, the food source for microorganisms that live in the soil, are significant factors of the soil health initiative. By increasing soil carbon, microorganisms and other organic matter increase, thereby increasing soil structure. Microorganisms help build soil structure, provide nutrients to the plants, and increase the soils water holding capacity as well as fertility. Improved soil structure reduces soil runoff, soil erosion, and losses from flooding, through improved plant growth. Through this process, water quality is improved as well as the quantity of water that flows through the soil profile and into the aquifer. Using this knowledge, and by implementing established management strategies, soil and water functions would show improvement. Areas under consideration include Aquifer Protection Lands (i.e., properties set aside strictly for ground water recharge) and San Antonio city parks.

Future Goals

The overall goal is to make San Antonio Climate Ready for future changes in the environment. To achieve this goal, the Region 9 Soil Survey Office (SSO) staff in Kerrville, TX will assist in selecting sampling locations, determine sampling time frames, and help train members of the Alamo Area Master Naturalist group in sampling protocol. NRCS TX staff will assist with conservation plans and strategies to manage San Antonio lands to improve soil carbon. Areas where cover crops could potentially be used to jump start microorganisms and increase carbon will be identified. On traditional rangeland settings, native and exotic wildlife needs will be considered, and may include rotational grazing, allowing cover crops time to establish. Adopting new management styles may take time, however making changes now will achieve the goal of providing clean drinking water to the current and future population. The Urban Ecosystem Carbon Management project will incorporate all facets of Soil Science and allow soil scientists the opportunity to seek new ways to improve quality of life through proper functioning soils.

The graphic shows an example of a healthy root system and soil structure. Living organisms such as earthworms help aerate the soil, and the dark color is from organic carbon within the soil.

References

1. https://www.edwardsaquifer.org
2. http://www.saws.org/your_water/aquifer/
3. https://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/survey/?cid=nrcs142p2_054164