Evaluating the Potential of Nature-Based Carbon Sequestration in Rangeland and Cropland Soils: A Literature Review

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Background/Objectives. Accrual of atmospheric carbon in agricultural soils by means of improved farming and grazing practices can serve as a vital tool to offset CO_2 emissions to meet international emissions reduction targets. However, the understanding of potential rates of soil carbon sequestration and how they vary across the landscape under different land management scenarios is a key data gap in understanding how to optimize carbon accrual through these practices. In this study, we compile and analyze published information on soil carbon sequestration projects worldwide to characterize the rate of carbon accrual achieved in different soils, climate, and land management programs.

Approach/Activities. We derived soil carbon sequestration rates from projects in over 10 countries to investigate the effects of various land management practices on soil carbon levels, which range from grazing and cropping management to land use conversion. Key parameters of interest include the soil type, climate, applied land management practices, soil carbon content measurements over time, and other site-specific characteristics. Statistical analyses of these data yield information of the effect and relative importance of variables such as precipitation, land management, and soil type on carbon storage rates.

Results/Lessons Learned. This analysis shows within the same project area, the coefficients of variations (CV) of carbon content range from 9% to 59% with the median CV at 8%, demonstrating the significance of localized variables including natural conditions and land management practices. Analyses attempt to quantify the variability in carbon content measurements under specific conditions. Results from the evaluation of carbon sequestration rates show that different land management practices have different impacts on changes in the soil carbon stock. Correlation and multivariate analyses underway will provide evaluations on impacts of certain land management practices on soil carbon content, and ways to estimate carbon accrual. This work will provide important insight regarding the effect and relative importance of key variables in predicting soil carbon accrual rates. This information will be a useful tool for farming and grazing operations seeking to optimize soil carbon storage both in terms of rate and magnitude.