Climate-wise management: Soil mineralogy's primary influence on soil organic matter in Hawaiʻi

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Over a century of intensive, large-scale plantation monoculture farming in Hawaiʻi has left almost half of arable lands in fallow. Hawaiʻi agriculture and land use is at a pivotal point as the state strives to develop sustainable production and management systems that contribute to increasing local food security, improving air and water quality, building healthy soils, and sequestering carbon. We propose the Hawaiʻi Soil Health Index to serve as criteria for these goals. Soil organic matter (SOM) is central to soil function and health [1] due to its strong influence on physical [2], chemical [3], and biological [4] properties. Soil health indicators are designed to assess the soil's ability to provide ecosystem services and sustain plant, animal, and human life. Soil health indicators also measure dynamic soil properties, thus, change due to management can be measured quickly and efficiently [5]. However, for soil health to be accurately used as a tool by land users the indicators must be calibrated for local conditions to establish sensitivity, measured threshold values, and to understand soil health's relationship to yield and carbon sequestration [6,7,8]. We sampled eight of ten of the soil orders and differing land uses (cropland, forest, and grassland) across the Hawaiian Islands and measured nine soil health metrics. We hypothesize that minerology, especially in the case of Andisols (volcanic ash-derived, amorphous clay), plays a predominant role in carbon and SOM storage compared to land use. We also hypothesize that Inceptisol soils (low development), where clay accumulation is low but the type of clay mineralogy varies, will show differing levels of SOM and carbon sequestration based on low to high activity clay mineralogy. These inherent soil properties must be considered in scoring soil health, especially relating to SOM and carbon sequestration.

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