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Land use changes in sugarcane to develop degraded land into a carbon sink: A farmer's perspective

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Soil on my 100 ha sugarcane farm was developed over the last 10,000 years though the deposition of marine sediments during sea level rise. The sulfidic Hydrosol (WRB) is characterized by marine mud with a thin layer (ca. 100mm) of peat overtopping. The farm overlies a relatively shallow groundwater source heavily influenced by seawater (ca. 20,000 μS/cm). During the development of the Tweed Valley in the 1920's into cropping land, much of the peat was burnt, and an extensive network of drains was established to allow year-round farming. However, by draining these soils, large quantities of sulphuric acid were generated, degrading the soils and causing off-site impacts such as fish-kills. Acid scalds were common, and many areas only grew salt-water weeds. Potential mineral acidity in the soils has been measured at over 100 t H2SO4/ ha, giving significant management issues to this day. During the 1960's, floodgates and levees were installed to improve drainage, but this resulted in further mineral oxidation, and soils were measured with a pH of 2.6 (H_2O). Declining sugarcane yields over the next 30 years meant new soil management was needed to facilitate continuing farming.
In the 1990's, I invested in laser levelling to improve drainage, regular liming, and have adopted several agronomic practices to improve organic matter input and quality into soil. These practices included green cane harvesting with trash retention, minimum tillage practices and the use of legume break crops. I have also minimized the application of acid forming fertilizers such as urea by soil testing and only adding replacement quantities of N. I maintain the water table at minus 600mm with automated flood pumps which ensures the metals (including H+) and salinity drain through the profile giving roots a much improved environment. Now, my soils have a surface pH of nearly 6 (H_2O), and the organic C content has increased from under 2% (in 1990) to over 5% in the surface soils. This equates to a conservative estimate of an additional 4800 t C stored on the 100 ha property since 1990 (soil BD is 1.6). While lowering the water-table potentially increases oxidation through the profile, the increased organic C content may offset this by lowering soil redox potential and through increasing soil aggregate stability. Research has shown that acid discharge from my 100 ha property has declined since 1990. I continue to support research activities at my farm on mixed cover cropping and the role of enhanced efficiency fertilizers, and geochemical processes involved in acid sulphate soils. While there are many scientific questions remaining, I regularly harvest 93t sugarcane/ ha compared to a global rain-fed average of around 38 t/ ha. This sustainable yield and improvement in soil characteristics justified the additional work and expense of the adopted soil management practices. This is a good news story with outcomes that have potential widespread benefits.