Multiple benefits of biochar in agrivoltaics including rainfall harvesting and water balance

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Biochar as a carbon-negative product from organic waste increases porosity and water availability when deployed and mixed with soil, as one of many benefits for agrivoltaics projects. Biochar can mitigate climate change by locking away carbon in concrete and during steel production, supporting food security and a circular economy, producing composites for water treatment and nutrient availability, and restoring soils affected by sodicity or contaminants. However, the utilization of biochar in combined farming and large-scale solar PV projects (i.e., agrivoltaics) provides more opportunities such as credits for carbon dioxide removal (CDR) and increased land-use efficiency. This project at a 7-megawatt solar PV (14-hectare) mixed-use farm at Deakin University in Australia aims to evaluate how biochar could contribute to agrivoltaics, particularly its influence on soil moisture, nutrient availability, and pasture productivity. This presentation focuses on part of the datasets, with initial results for water availability in the soil and pasture for sheep grazing. We applied biochar into a hand-dug trench along the drip line of PV panels, with several reference sampling sites (0.6m deep holes) beyond the pasture that is shaded by the panels. The trench was 0.6 m deep and 0.3 m wide, with 0.1 m of drainage sand at the base, a 0.3 m thick layer of mixed straw-biochar followed by 0.1 m of biochar particles, and 0.1m of soil and grass. Pasture treatments of liquid biochar and fertilisers followed installation. Soil moisture sensors were installed in the trench and sampling sites at 0.1, 0.3, and 0.5 m below ground level, and volumetric soil water content (V-SWC %) was recorded every 15 minutes. The initial results showed that the biochar trench in the mid-depth zone (~0.3m below the ground) can retain ~45% soil moisture after initial rainfall events. The maximum value of V-SWC in the bottom zone of the biochar trench was 47%. Similarly, V-SWC trends at other sites indicated that the middle and bottom zones can hold water for a period of time after rainfall occurs and values were up to 20%. Ongoing analysis will include variations of soil carbon and nitrate and the chemistry of leachate water that is collected from piezometers that were installed in the sand base of the trenches for mini-monitoring. The findings of this project will be useful for wide-scale applications of biochar on agrivoltaics or farming projects in environments sensitive to water balance. Biochar in soils can act as a sponge to store more water, slow down water flows in rivers, and increase groundwater recharge to shallow aquifers. This could ensure local catchments are more resilient to dry periods.
while benefiting ecosystems, and production of renewable energy and farmland.