Testing of photogrammetry for differentiation of soil organic carbon and biochar in sandy substrates

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Landforms in different environmental ecosystems are formed through selective erosion and transport mechanisms by wind and water. To understand their development, biochemical composition, and effect on neighbouring ecosystems, it is essential to better understand the forming processes and to be able to monitor the behaviour and transport of particles through the landscape. Conventional methods to track and differentiate between organic and inorganic particles usually involve extensive sampling campaigns that disturb the processes themselves. Therefore, this study aimed to prove that the method of photogrammetry, which is non-contact and non-invasive, is able to quantify erosion rates and can also be used to differentiate between organic and inorganic material. To prove this concept, a bottom-up experimental rainfall simulation set-up was conducted with sieved sand substrates of very narrow particle size distribution and biochar under highly controlled conditions. By using two-dimensional index and reflectance maps of the surface computed with the software Pix4D, the erosion of biochar was estimated and compared to the actual erosion amount that was transported along the plot. The results show that photogrammetry has the potential to distinguish between a sandy substrate and biochar. An approximate decrease of 5% in biochar on the plot surfaces was detected in three out of four rainfall experiments within the first 30 s. After these 30 s, the quality of detection was significantly reduced due to shadow effects, which were falsely classified as biochar as well. For future investigations on this topic, it will be necessary to improve the lighting of the plot and the post-processing of the images to reduce the error caused by shadows. Additional approaches that should be taken into account for further test experiments are the full exclusion of external light, which means working in the dark, and the use of hyperspectral cameras to detect different carbon types.

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