

Digital soil mapping enables informed decisions to conserve soils within protected areas

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May 27, 2023

Abstract

Protected areas are often regarded as pristine land, but in reality, they require rehabilitation and effective management to prevent increased land degradation. Soil management requires soil maps to make informed decisions, which is difficult to create in protected areas due to the large size of land, limited accessibility, little available soil data and limited budgets of such projects. In this paper a hybrid expert knowledge and machine learning digital soil mapping (DSM) method is used to create such maps for Benfontein, a 9900 ha protected area in the semi-arid region of South Africa. The hybrid method uses soil landscape rules to determine virtual soil observations which is added to the training observations used in a machine learning algorithm to create a soil associations map. Soil properties were assigned to each soil class at the 0.1, 0.5 and 0.9 percentile level, to indicate the range of properties at an 80% certainty. The soil maps were interpreted to indicate soil carbon sequestration potential, soil erodibility and off-road driving potential. The soil association map was acceptable as it achieved a kappa value of 0.69. Additionally, it was determined that the site has a large potential for carbon sequestration, the soils are relatively stable against water erosion, and off-road driving should be prohibited on approximately half of the area. The results indicate that the hybrid DSM method is viable to create useful soil maps to inform management decisions in the unique settings of protected areas.

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