SOC erosion and its subsequent fate in the Karoo rangelands

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Background

While Soil Organic Carbon (SOC) directly affects a soil's vulnerability to erosion, possible influences on soil and sediment Phosphorus (P) dynamics are still unknown.
This ongoing study aims to identify and characterize source and sink areas of sediments within a catchment area and their to SOC and P dynamics.

Study Site

The studied catchment is part of the Great Karoo region of South Africa. In the early 20th century many dams and reservoirs have been constructed to provide drinking water for cattle or to facilitate irrigation during dry periods as a result of agricultural intensification. The studied dam (31.698536°S 24.588206°E) was probably constructed in the 1920ies and breached only 50 years later when it was already filled to the top with ca. 38000 m^3 of sediment.

Methods

Surface soil samples were taken randomly throughout the catchment area and were analysed for texture, Total Organic Carbon (TOC) and Total Phosphorus (TP) content. Land Cover was assessed on-site using the following parameters: vegetation type, % and size of stones, % of bare soil. The land cover classification will be compared and refined using drone imagery (large-scale) and detailed vegetation mapping (small-scale).

Preliminary Results

- TOC to clay-content correlation was strongest for samples from depositional areas (Fig. 1). A correlation between TP and particle size was not found.
- Clay-content was lower in depositional areas than in eroding areas (Fig. 2)
- TOC was lowest in depositional and eroding areas, both are also characterized by a lower vegetation cover (Fig. 2)
- TP is slightly higher in depositional areas (for this catchment) (Fig. 2)

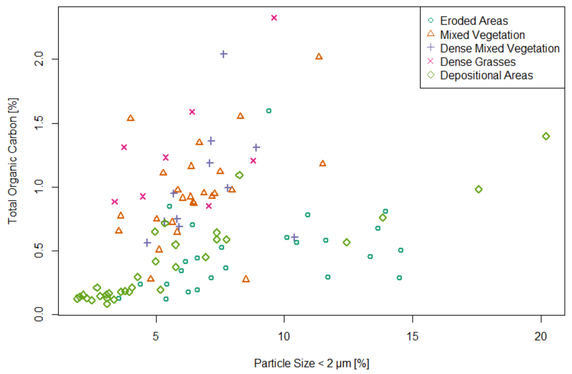

Fig. 1: TOC seems to be positively correlated with the amount of clay-particles within each land-cover class.

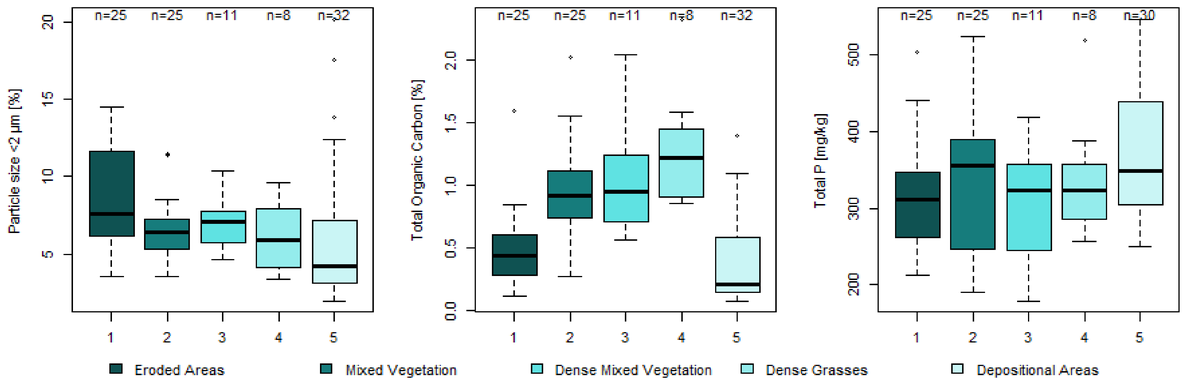

Fig.2 Studied variables (Clay-content, TOC and TP) in comparison to determined Land Cover classes.

Conclusion

Low TOC in the top layers of the reservoir-infill, and in the eroded source areas, supports the assumption that the eroded material was transported from the degraded areas down into the reservoirs, where it settled.
TP dynamics for this catchment are only poorly understood yet. It does neither seem to be predominantly associated with a certain land cover class nor with a certain particle size.
Differences in soil properties within the catchment are likely to be explained by degradation or different parent material right from the start.

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