

## **Fractal geometry of aggregates in natural grassland soils with different restoration stages**

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**Abstract** Severe soil erosion occurs over 70% of the Loess Plateau in China. In this study, the fractal geometry of micro-aggregates were determined to compare fractal dimensions of the soils and physical and chemical characteristics of the soils in different restoration stages on the Loess Plateau. The results show that the fractal dimension of upper layer soil micro-aggregates decrease with increased restoration time. The fractal dimension (D) of soils at 0–20 cm changed from  $2.360 \pm 0.008$  to  $2.494 \pm 0.015$  with different restoration stage, while D changed from  $2.441 \pm 0.009$  to  $2.488 \pm 0.016$  at 20–40 cm and from  $2.478 \pm 0.028$  to  $2.492 \pm 0.027$  at 40–60 cm. D was significantly different ( $p < 0.01$ ) for particles  $< 0.001$  at 0–20 cm. D increased with increasing sand content but decreased with increasing clay content. D was positively correlated with bulk density, non-capillary porosity, porosity ratio, total phosphorus, available potassium and ammonia nitrogen, but negatively correlated with capillary porosity, soil organic matter and total nitrogen.

**Keywords** erosion environment; soil micro-aggregates; fractal dimension; different restoration stage