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

ZHOU PING¹, WEN ANBANG¹, ZHUANG WENHUA²,³ & LIU GUOBIN³

¹ Institute of Mountain Hazards and Environment, Chinese Academy of Sciences, The key Laboratory of Mountain Surface Processes and Ecological Regulation, Chengdu, Sichuan 610041, China
ZHOUping04@gucas.ac.cn
² College of Water Conservancy and Hydropower, Sichuan University, Chengdu 610065, China
³ State Key Laboratory of Soil Erosion and Dryland Farming on Loess Plateau, Institute of Soil and Water Conservation, Chinese Academy of Sciences and Ministry of Water Resources, Yangling, Shaanxi 712100, China

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 ± 0.008 to 2.494 ± 0.015 with different restoration stage, while D changed from 2.441 ± 0.009 to 2.488 ± 0.016 at 20–40 cm and from 2.478 ± 0.028 to 2.492 ± 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