The impacts of changing rangeland into forest park on availability of heavy metals

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Soil pollution with heavy metals is an ever growing concern due to the potential threat to food safety and detrimental effects on human and animal health. The uptake of metals by plants and ingestion by humans depends on their bioavailability in soil. Since landuse has tremendous influence on soil properties, it can also affect the availability of heavy metals. In order to assess the effect of changing landuse on bioavailability of Cu, Mn, Fe and Zn, a total of 116 surface soil samples were collected from three landuses: rangeland (RL), needle leaf (NL) and broad leaf (BL) forest (all land uses were under rangeland before 1966). The available (DTPA extractable) and total Cu, Mn, Fe and Zn concentrations, pH, organic matter, calcium carbonate and soil texture were measured using standard methods. Statistical analyses (e.g. correlation and ANOVA) indicated a significant difference in available form of all heavy metal (Cu, Mn and Zn) concentrations except Fe among the landuses. Soil organic matter was greatly influenced by the landuse type. A positive correlation between available form of heavy metals (especially Zn) and organic matter was also observed. Spatial distribution (determined using geostatistical methods) of available Cu and Mn was very similar within the region. Availability of these two elements was mainly affected by the amount of calcium carbonate present within the region. In contrast, available Zn showed a different spatial distribution and its availability was mostly under the influence of soil organic matter. Availability of Fe was affected by the amount of calcium carbonate and soil organic matter present within the study area. Information on the spatial distribution of heavy metals as influenced by soil properties which in turn controlled by landuses is important in understanding the extent and severity of soil pollution and its potential impacts in the converted parklands.

Scale-variability of surface microtopography on a highly-stable soil under simulated rainfall

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Soil roughness depends on extrinsic and intrinsic factors that influence structural organization at the soil surface and it contains information on scale organization of processes such as clod fragmentation, runoff, sedimentation, and crust formation. Our objective was to evaluate changes of soil surface roughness with rainfall using a multifractal approach. After a disc plow operation on a Rhodic Kandiudalf, 20 plots (1 m^2) were established. Rainfall was applied at an intensity of 120 mm h^{-1} in quintuplicate plots at amounts of 0, 40, 80, and 120 mm. After a 24 h drying period, elevation data of the plots was collected in a regular grid with a laser microrelief meter with 10 mm resolution. Two undisturbed soil blocks (12 x 12 x 5 cm) were collected from each plot and one was scanned with a multistripe laser triangulation (MLT) scanner resulting in an irregular grid. Field and block elevation grids were converted to gray-level images at resolutions of 100 and 200 $pixel^2$, respectively. Multifractal $f(\alpha)$ spectra were calculated using a box-counting technique applied to the images. The variance of the elevations (mm^2) at field scale decreased linearly with rainfall from 116.62 at no-rain to 63.37 after 120 mm (R^2=0.992), but there was no clear trend at the block scale. Although there were visual differences in $f(\alpha)$ spectra of individual plots, multifractal parameters were not different ($P>0.05$) across rainfall amounts at either scale. The shape of $f(\alpha)$ was effected by scale, with the $f(\alpha)$ from the blocks being more asymmetric ($P=0.06$) and narrower ($P<0.001$) than from those from the field. The sensitivity of the $f(\alpha)$ spectra to rainfall amount may be enhanced by a technique taking into account all the elevation points in the mesh and their distances.