Impact of floods on soils

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A recent study conducted in the Midwestern United States examined the effects of harsh wet conditions on both cultivated and uncultivated soils, vastly advancing the knowledge of water's effects on aggregation. Soil aggregation is an important soil attribute that is related to the physical-chemical state of the soil, and is one of the essential processes that determine soil quality. During the wet season in the U.S. Midwest, upland soils are often under water for days or weeks, causing oxygen depletion, or reducing conditions, which may in turn affect the chemistry of the soil-water system and, consequently, soil aggregation. Loss of soil aggregation impacts agriculture by decreasing soil quality and crop production.

Recently, soil scientists investigated how changes in the reduction-oxidation (redox) status of the soil can impact soil aggregation during short-term ponding conditions. The group included Alfredo De-Campos, a former graduate student from Purdue University, and Amrakh Mamedov and Chi-hua Huang, from USDA Agricultural Research Service, National Soil Erosion Research Laboratory at West Lafayette, IN. Results from this study were published in the March/April, 2009 issue of Soil Science Society of America Journal.

To carry out the research, six different upland soils, three cultivated and three uncultivated, with different organic carbon and similar mineralogy were incubated up to 14 days in an anaerobic biogeochemical reactor. After each treatment, the soil solution was analyzed for metals and dissolved organic carbon. A simple laboratory procedure that measures the degree of aggregate breakdown during wetting was used to determine

aggregate stability of the incubated soil samples.

The research revealed that the aggregate stability of upland soils was decreased under reducing conditions from short-term water ponding. The decrease in aggregate stability reached approximately 20% during a 14-day ponding period, which is quite significant in terms of soil disaggregation. Changes in redox sensitive elements, alkaline metals, and dissolved organic carbon under reducing conditions contributed to the decrease in aggregate stability.

Overall, the aggregate stability of cultivated soils was more affected by the reducing conditions than that of uncultivated soils. This indicates that the management system plays an important role in the stability of aggregates.

The use of natural soils without addition of chemicals simulated a realistic field situation when aerobic upland soils remained saturated for several days and the oxygen level depleted to a minimum, causing reducing conditions. The authors believe that once the reducing reactions take place in the field and disaggregation has occurred, the process will not reverse itself because the natural drainage will carry away the released chemicals and the chemistry of the soil-water system will not return to the original state. The disintegrated aggregates may clog the soil pores and further degrade the soil structure.

However, reducing conditions only occur for short periods of time during the wet season in upland soils, whereas aggregation processes operate for several months causing re-aggregation of soil particles. The long-term irreversibility in soil disaggregation caused by the short-term reducing conditions remains an open question.

More information: soil.scijournals.org/cgi/content/abstract/73/2/550

Source: Soil Science Society of America (news : web)