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Soil physical conditions as livestock treading effect in tropical Agroecosystem of dryland and strategies to mitigate desertification risk

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Soil degradation in natural ecosystem of arid and semi-arid zones of Venezuela due to livestock treading (goats) it is an important problem that affect their environment functions; increase soil erodibility, bulk density, water losses and reduce porosity, water infiltration rate and soil structural stability. The presence of biological crust (BSC) in this type of soil it is very common. The objective of this study was to evaluate the soil surface physical quality through the use of selected indicators, mainly some of that related to structural stability, infiltrability and the prediction of soil erosion risk in two zones of Lara state: 1) Quíbor (QUI) and 2) Humocaro Bajo (HB). The study was conducted on two selected plots (30 m x 20 m) in each zone, with natural vegetation and BSC cover, with areas affected by different degree of compaction due to treading in the paths where the goats are moving. Five sites per plot (50 cm x 50 cm) under vegetation cover and five sites over the path with bare soil were sampled (0-7,5 and 7,5-15 cm depth). The results showed that soil macroaggregate stability (equivalent diameter of aggregates >0,25 mm) was significantly higher ($p<0,05$ %) in soil with vegetation cover and BSC compared with bare soil. Sealing index, as a measure of aggregate stability, determined in laboratory under simulated rain and expressed as hydraulic conductivity of soil surface sealing (Kse), decreased with decreasing soil vegetation cover and the presence of BSC. However, Ksei (i: inicial) and Ksef (f: final) were significantly greater in soil with more than 75 % of BSC in comparison to bare soils. The sealing index it is used to for to estimate changes in soil water losses. As the sealing index increases, the susceptibility of the soil to undergo surface sealing or slaking decrease. These results suggested that soil physical properties are potential indicators of soil quality with regard to soil erodibility and showed that soils under vegetation cover had higher quality level than bare soils. Some predictive regression equation had a high R2 value and was a useful tool for to evaluate the risk of extreme climatic changes and to mitigate their detrimental effects. We conclude that the global climatic change (CCG) will have a negative effect on these agroecosystems functions, mainly in soil and water conservation, carbon sequestration, and productivity. Natural recovery of soil physical properties from treading damage of pastoral soils will be possible in the future with the implementation of soil management strategies, mainly through re-vegetation and recuperation of the BSC.

Key word: Soil structure; aggregate stability; soil sealing index; hydraulic conductivity of surface sealing.