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The compactness of soils: a major physical indicator of their potentiality

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The compactness of soils, measured by their bulk density, is, among the physical soil properties, a major indicator of one of the three groups of indicators of soil quality. It is of major interest to soil physicists, pedologists, engineers, hydrologists, biologists, ecologists and agronomists. The soil bulk density depends on endogen (physico-chemical properties of soils and rocks) and exogenous factors (climate, uses of ecosystems). It generates several physical, hydrodynamic and biological dysfunctions that lead to the degradation of ecosystems by the loss of nutrients and useful water. This is at the origin of the fall of production with an important socio-economical cost.

This study realised in the desertic to sudano area, shows that the climatic and anthropogenic causes combine to reduce the agronomical potentialities of ecosystems. Agricultural and ecological planning decisions can be undertaken only after the determination of the apparent density of soil and the risk of its modification. In fact, it reflects the nature and organisation of soils components and of their impact on the conditions of sustainable growth.

The dense horizons often reduce the development of roots. Its variation explains the variability of hydrological characteristics of soils and the values of the maximum amount of water in the aggregates. This is due to cultural practices in rain or irrigated agriculture. However the current or past climatic change has also a role on the superficial or deep compaction of several soils. The organic carbon content appears a major discriminating factor direct or indirect. It is also a key-property used in many simulation models of the hydrological balance, the risk of erosion and this for a large

choice of pedological processes.

Since a long time predictive mathematical models have been elaborate empirically either on simple systems or on different mixtures with large differences in the size of particles for real or reconstructed soils. The large amount of these models shows that they are not universal and most often, they are specific of the analysed material or the studied area. Thus they can only be used in the restrained area they have been developed.