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### **Introduction**

Soil compaction is a form of physical degradation in which soil biological activity and soil productivity for agricultural and forest cropping is reduced, resulting in environmental consequences away from the immediate area directly affected. Compaction is a process of densification and distortion in which total and air-filled porosity and permeability are reduced, strength is increased, soil structure partly destroyed, and many changes induced in the soil fabric and in various characteristics. The term "compaction" is used to identify a process and should be distinguished from the term "compactness", which indicates for a given time and position the state of packing of the solid soil constituent.

The compaction process can be initiated by wheels, tracks or rollers, the passage of cultivation machinery, and the passage of draft or grazing animals. Soil densification can also be caused by heavy overburdens of ice and snow and by illuviation of clay from the A-horizon into the B-horizon. These processes may take place slowly over long periods of time and will result in the B-horizon having much higher bulk density and strength than the A-horizon. Densification also occurs as a result of structural collapse near the soil surface due to the impact of rain, resulting in formation of surface crusts.

In arable land with annual ploughing, both topsoil and subsoil compaction should be considered. We define the subsoil as the soil below the loosened layer (about 20 - 35 cm thick). This definition of the subsoil includes the panlayer as the upper part of the subsoil. This panlayer is, in many cases, less permeable for roots, water and oxygen than the soil below it and is the bottleneck for the function of the subsoil. In contrast to the topsoil, the subsoil is not loosened annually, compaction is cumulative, and, in the long run, a more or less homogeneous compacted layer is created. The resilience of the subsoil for compaction is low and subsoil compaction is at least partly persistent.

Problems of compaction are widely distributed throughout the world, but tend to be most prevalent where heavy machinery is used in agriculture or forestry, in both temperate and tropical areas. Soils that are naturally fragile in structure, such as soils of the humid tropical forest and light-textured soils in areas of low but erosive rainfall, are particularly prone to problems arising from compaction and subsequent high risks of erosion due to reduction of permeability. Compaction is now included in surveys of soil degradation and preliminary estimates have suggested that the area of degradation attributable to soil compaction may equal or exceed 33 Mha in Europe and 18 Mha in Africa. A project on mapping of Soil and Terrain Vulnerability in Central and Eastern Europe (SOVEUR) by the FAO and ISRIC showed that compaction is the most widespread kind of soil physical soil degradation in these countries. About 25 Mha proved to be lightly and about 36 Mha moderately compacted.