

SOIL RESILIENCE (IS SOIL A RENEWABLE NATURAL RESOURCE?)

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Introduction

Definitions:

Sustainable: „Enable to keep up (from falling or sinking); to maintain a certain situation, level, or quality for a longer period.”

Renewable: „That can be renewed or being renewed”; *renew:* „as good as new”; *restore* to the original condition.” (The Advanced Learner’s Dictionary of Current English).

Resilience: „Quality or property of quickly recovering the original shape and conditions after being stressed (pulled, pressed, crushed etc.)”;

Soil resilience: „The soil’s ability to recover after disturbance; or to return to a new dynamic equilibrium” (Greenland and Szabolcs, 1994).

Soil resilience

Soils worldwide are being subjected to increasing degrees of physical, chemical and/or biological; natural or human-induced *stresses* (Greenland and Szabolcs, 1994; Láng, 2003; Várallyay, 2005):

- extreme climatological or hydrological situations (Várallyay, 2006);
- inappropriate agricultural management (irrational land use and cropping pattern; inadequate tillage operations, plant nutrition or plant protection technology, irrigation practice; over-sized and over-concentrated livestock farms) (Csete and Láng, 2005; Greenland and Szabolcs, 1994; Láng, 2003; Szabolcs, 1993);
- industry, mining, infrastructure, rural and urban development with their unavoidable „waste production”.

The satisfaction of the rapidly increasing demands of the ever-growing world’s population, the improvement of their living standard and the *quality of life* (sufficient quantity of high-quality healthy food; clean water; pleasant environment; etc.) need a more efficient utilization of the natural resources, in particular the unique property of *soil fertility/productivity*. The key of their sustainability is *soil resilience* (Greenland and Szabolcs, 1994; Szabolcs, 1993; Várallyay, 2006).

The resilience of some soils allows a natural and rapid recovery. Others may require assistance in the form of water regulation systems (irrigation or drainage), manure or fertilizer application, reclamation/amelioration measures, proper agrotechnics, etc. (Csete and Láng, 2005). The extent of the effectiveness and efficiency of these interventions, which are the keys of sustainable soil management, depends on *soil resilience*.

Renewable or not?

A great majority of soils show „significant” resilience, consequently they are „renewable natural resources”. Soils bear their multifunctionality since the beginning

of primary soil formation in the early geological periods, much before the appearance of man. They still exist, do not loose their „fitness”, their multifunctional ability:

- medium for biomass production, primary food source of the biosphere;
- reactor and transformer of the integrated influences of other natural resources;
- storage of heat, water, plant nutrients and – in some special cases – wastes;
- high capacity buffer medium, natural filter and/or detoxication system;
- gene reservoir and important element of biodiversity;
- conservator of natural and human heritages.

The renewal of soil multifunctionality does not go on automatically, and the maintenance of soil resilience needs special conservation actions and permanent care to ensure the conditions for it:

*soils are **conditionally renewable** natural resources*

(Arnold, Szabolcs and Targulian, 1990; Greenland and Szabolcs, 1994; Várallyay, 2003).

Without such activities soils are not (or slowly and weakly) resilient and not (fully or at least properly) renewable, as it was formulated in the new European Soil Conservation Strategy. This „dramatic” definition was found necessary probably to shock politicians and decision-makers and press them to do something (priority setting, law regulations, financial support) for the *sustainable* use of soil resources and for their conservation. Such decisions are absolutely necessary for ensuring the conditions of renewal, helping soil resilience. The necessity of such regulations and measures were clearly, but painfully proven by human history.

Threats to soil resilience

Society and the human-induced (human-created, human-affected or human-destroyed) environment have used the natural resources, including soils, irrationally, forgetting about sustainability; sacrificing the future for present and egocentric purposes. The short-term thinking over-exploitation of soils lead to reversible or irreversible, sometimes catastrophic consequences, ancient cultures were destroyed by soil deteriorations (floods, wind or water erosion, salinisation, volcanic sedimentation etc.). Large areas were affected by various soil degradation processes, extreme moisture regimes (floods, waterlogging, droughts), organic matter and plant nutrient losses, biodiversity losses (Tóth et al., 2004; Várallyay, 2006).

These unfavourable facts have been registered, assessed and mapped (1:5M with some 1:1M and 1:500 000 „windows”) in the GLASOD (Global Assessment of human-induced Soil Degradation) Program, expressing their extension, degree, trend and analysing their potential reasons (Oldeman et al., 1990).

The European Soil Conservation Strategy (Várallyay, 2005) emphasizes 8 main threats for soil resources (Figure 1).