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Effect of land use change on soil properties and functions

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For good base of sustainable land management and ecologically sound protection of soils are researches on soil properties and functioning. Ecosystem approach to soil properties and functioning is equally important in both natural and cultivated land use conditions. Comparative analysis of natural and agro-ecosystems formed on similar soil types enables to elucidate principal changes caused by land use change (LUC) and to elaborate the best land use practices for local pedo-ecological conditions.
Taken for actual analysis mineral soils' catena – rendzina → brown soils → pseudopodzolic soils → gley-podzols – represent ca 1/3 of total area of Estonian normal mineral soils. All soils of this catena differ substantially each from other by calcareousness, acidity, nutrition conditions, fabric and humus cover type. This catena (representative to Estonian pedo-ecological conditions) starts with drought-prone calcareous soils. Brown (distributed in northern and central Estonia) and pseudopodzolic soils (in southern Estonia) are the most broadly acknowledged for agricultural use medium-textured high-quality automorphic soils. Dispersedly distributed gley-podzols are permanently wet and strongly acid, low-productivity sandy soils.
In presentation four complex functions of soils are treated: (1) being a suitable soil environment for plant cover productivity (expressed by annual increment, Mg ha-1 yr-1); (2) forming adequate conditions for decomposition, transformation and conversion of fresh falling litter (characterized by humus cover type); (3) deposition of humus, individual organic compounds, plant nutrition elements, air and water, and (4) forming (bio)chemically variegated active space for soil type specific edaphon. Capacity of soil cover as depositor (3) depends on it thickness, texture, calcareousness and moisture conditions. Biological activity of soil (4) is determined by fresh organic matter influx, quality and quantity of biochemical substances and humus, and pedo-ecological conditions.
LUC from natural to arable is accompanied by different regulations: (1) regular restoration of plant available nutrition elements' stocks in soil, (2) regulation (if needed) of water regime of gleyed and gley soils, (3) optimizing of soil actual acidity by liming, and (4) forming a suitable for crops seed bed instead of natural epipedon. Principal changes are occurred in fabric and agrochemical properties of topsoil and in soil functioning. The connected with LUC changes in soil functioning are: (1) increase of openness level of chemical elements cycling and nutrition elements concentration in phytomass, and (2) decrease of total phytomass, species diversity, amount of annual falling litter and content of mortmass in soil cover. These changes lead to decreasing of biological control on soil resources, flux of energy and substances to soil processes, and volume of cycling. At the same time the intensity of organic matter decomposition and outflow of nutrition elements are increased. All these changes are resulted by alteration of food chains and exhausting of nutrition elements' stocks.
The changes in soil functioning (decrease or increase of productivity) depend much on soil type. The aspects of functioning, which do not changed with LUC are chemical-textural potential of soil cover and functioning character of subsoil. The sound matching of soil and plant cover is of decisive importance for sustainable functioning of ecosystem and in attaining a good environmental status of the area.