

Soil threats are degradation-causing processes that result from direct human activity or indirect causes such as climate change. They pose a potential risk to soil functions and ecosystem services.

The following are the main soil threats to agricultural land identified in the iSQAPER research programme and addressed in SQAPP: the soil quality app.

Erosion



Credit: Costas Kosmas

Erosion is the loss of soil from a field. Most commonly in agriculture fields, topsoil (including the finer, more fertile particles) is transported by water or wind. Erosion impacts on soil function by: reducing the available soil depth for plant rooting and provision of water; reducing cation exchange capacity, nutrients and organic matter availability. It also causes off-site impacts such as: silting (leading to reduction in the capacity of dams and reservoirs, reduced flow rates in channels); contamination of water bodies and eutrophication.

Organic matter depletion

Organic matter depletion is caused by an imbalance between soil organic carbon loss (through mineralization) and organic carbon input from plant litter (crop residues or spontaneous vegetation) or added organic matter (manures). Organic matter depletion impacts on soil function by: reducing nutrient retention and cycling; reducing aggregate stability and porosity; increasing susceptibility to erosion and salinization; reducing soil water holding capacity. All these changes affect plant growth and productivity.



Credit: Soil Science Society of Belgium

Compaction



Credit: Jordan Nelson

Compaction is the destruction of natural aggregates and rearrangement of soil particles to form more or less continuous masses of hard, high bulk density soil. Compaction occurs when a direct load is applied that exceeds the soil's bearing capacity and is caused by tractor and machinery traffic, tillage and intensive grazing. Compaction must be prevented because it is very difficult to reverse.

Acidification

Acidification is the increase in concentration of hydrogen in the soil's cation exchange complex. The main causes for acidification are ammonium rich fertilizers and the loss of cation bases, (especially calcium, magnesium and potassium) that are taken up by the crop or leached. Soil acidification impacts on: nutrient availability to plants; toxicity of certain chemical elements to plants (e.g. Al+++); organic matter mineralization (by creating unfavourable conditions for decomposer bacteria) and related nutrient release.



Credit: Mark Robinson

Nutrient depletion



Nutrient depletion is the negative balance of soil nutrients that affects plant growth over time. The main causes for nutrient depletion are: nutrient export with crop harvests that are not replenished in the form of fertilizers (both macro and micro nutrients); changes in nutrient availability (e.g. by chemical precipitation and leaching).

Credit: [موثلك نب ورمع](#)

Salinization

Salinization is the increase of salt content in the soil. The main causes are the presence of salts in irrigation water, rock weathering or the rise of water tables with a high quantity of dissolved salts (e.g. in coastal plains). Salinization has a direct impact on plant growth not only because of a higher soil osmotic pressure but also because it impairs the uptake of NO_3^- , Ca^{++} and K^+ , and causes the accumulation of Na^+ and Cl^- in leaves at toxic levels for the plant. Higher levels of Na^+ (and K^+) induce clay dispersion and loss of soil structure, further diminishing the ability of soils to sustain plant growth.



Credit: IRRI images

Soil biodiversity loss



Soil biodiversity loss is a complex degradation process that encompasses many negative feedback loops resulting in the loss of the soil's ability to sustain diverse macrofauna, microfauna and microorganisms. The main causes for soil biodiversity loss are: monoculture (or very narrow crop rotations); lack of or too widely dispersed natural land (for insect overwintering or egg deposition); soil compaction and excessive use of agrochemicals.

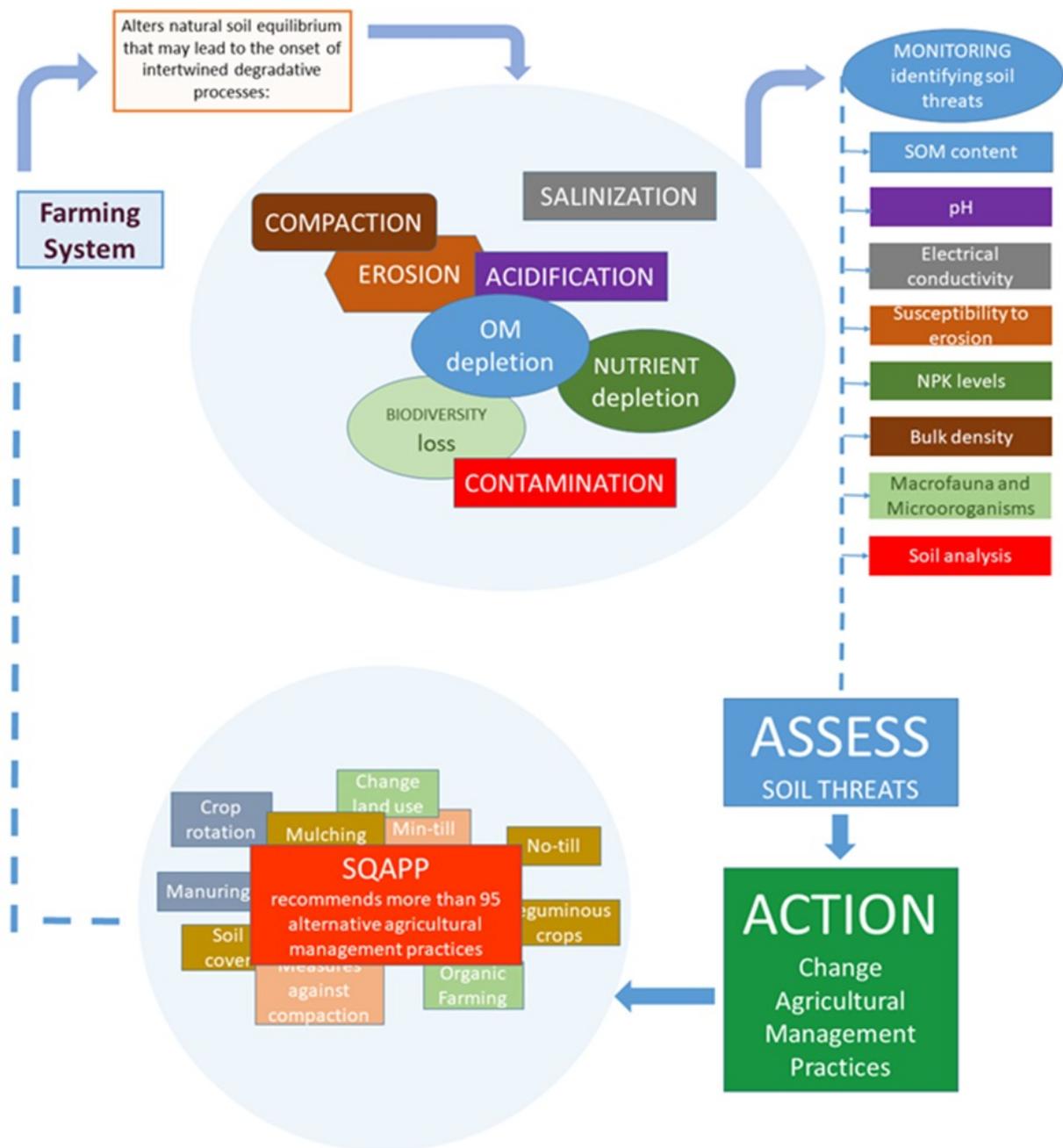
Credit: Gottlieb Basch

Contamination

Contamination is the accumulation in the soil of naturally occurring or man-made substances that exceeds a given threshold, limiting or impairing the soil's ability to function. The main causes are: the accumulation of pesticides used in the production system; heavy metals present in soil amendments (mineral and organic) or used to control fungal diseases; the deposition of pollutants from industries or mining activities.



Credit: Gabriel Jimenez



Cycle of soil threats assessment and remediation, including soil quality indicators.



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