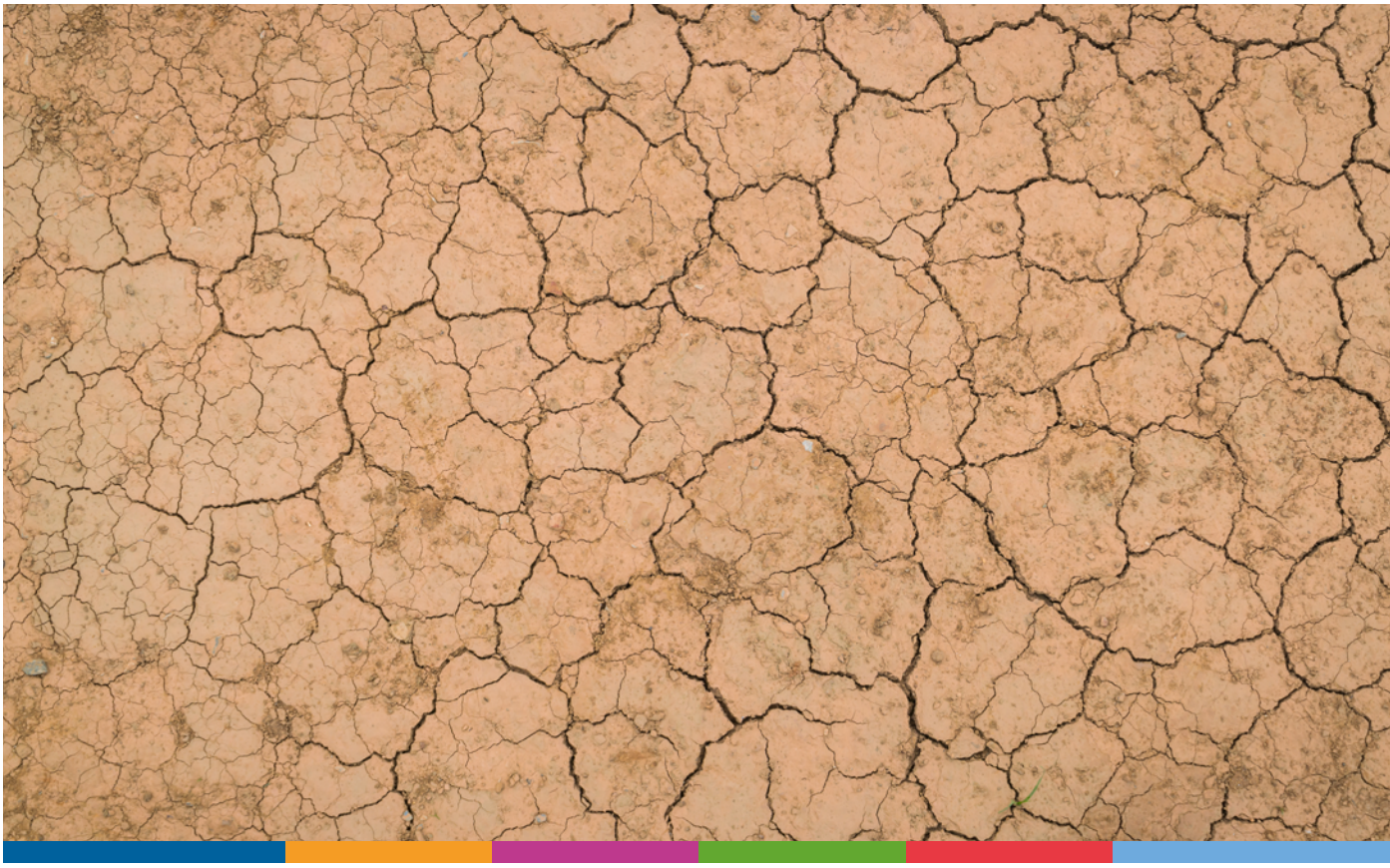
ProTerra FOUNDATION



Soil Degradation:

Erosion and Salinization

Soil is a crucial component of life physically keeping things alive, giving plants a place to put their roots down, besides containing the nutrients required for their growth. In a previous article, ProTerra has discussed the importance of soil conservation and erosion. On that occasion, the importance of soil was highlighted as an essential element for life as it literally sustains it.

- **It can take up to 1,000 years to produce just 2-3 cm of soil.**
- **33% of the Earth' soils are already degraded and over 90% could become degraded by 2050 (FAO and ITPS, 2015; IPBES, 2018).**

Soil degradation presents itself in a variety of ways, including erosion, salinization, decreased soil fertility, acidification, alkalization, deterioration of soil structure, loss of organic matter, and biodiversity.

The economic cost of soil degradation for the European Union is estimated to be in the order of tens of billions of euros annually.

The focus of this article is to highlight aspects related to erosion and salinization based on publications from FAO (Food and Agricultural Organization of the United Nations).

SOIL EROSION

Erosion is a process where earthen materials are worn away and transported by natural forces such as wind or water or by anthropogenic causes.

How does erosion occur?

According to FAO, soil erosion occurs naturally under all climatic conditions and on all continents, but it is significantly increased and accelerated by unsustainable human activities (up to 1 000 times) through intensive agriculture, deforestation, overgrazing and improper land-use changes.

Soil erosion rates are much higher than soil formation rates and, as the soil is a finite resource, its loss and degradation are not recoverable within a human lifespan.

- **The equivalent of one soccer pitch of soil is eroded every five seconds. (FAO and ITPS, 2015).**
- **Estimated rates of accelerated soil erosion on arable or intensively grazed lands are 100-1 000 times higher than natural.**

SOIL SALINIZATION

Salinization is a complex process that can develop in different ways in different areas, often caused by the over-exploitation of natural resources, in particular, unsustainable and inappropriate methods of agriculture and land use, and incorrect management of water resources, in special associated with irrigation.

How does salinization occur?

Salinization is a major soil degradation process threatening the ecosystem and is recognized as being among the most important problems at a global level for agricultural production, food security and sustainability in arid and semi-arid regions. Salt-affected soils have serious impacts on soil functions, including significant decreases in agricultural productivity, water quality, soil biodiversity, and soil erosion. Salt-affected soils reduce both the ability of crops to take up water and the availability of micronutrients. They also concentrate ions that are toxic to plants and may degrade the soil structure.

Soil erosion decreases agricultural productivity, degrades ecosystem functions, amplifies risks such as landslides or floods, causes significant losses in biodiversity, damages urban infrastructure and, in severe cases, leads to displacement of human populations. It can affect the infiltration, storage and drainage of water in the soil, resulting in waterlogging and water scarcity. In agriculture, FAO estimates that soil erosion can lead up to a 50 percent loss in crop yields.

Mitigation

The selection of appropriate measures to maintain soil erosion within a tolerable range is an essential component of sustainable soil management. The first group of measures to reduce erosion is aimed at minimizing land use changes (such as deforestation or improper grassland-to--cropland conversions) that leave the soil vulnerable to erosion.

The second and third groups of measures to reduce erosion involve protecting the soil surface from erosion and minimizing runoff depth and velocity on hillslopes (runoff is the name given to rainwater that runs superficially over the soil after a rain event).

A very common source of salts, directly associated with human activity, is irrigation associated with both the quality and quantity of water used.

Most irrigation waters contain some salts and often water is used in excess or without control.

Irrigation produces much of the world's food, but about 1/10 of the world's irrigated land has been damaged by salt erosion rates.

After irrigation, the water added to the soil is used by the crop or evaporates directly from the moist soil. The salt, however, is left behind in the soil. If not removed, it accumulates. This process is called salinization. Very salty soils are sometimes recognizable by a white layer of dry salt on the soil surface.
Salty groundwater may also contribute to salinization. When the water table rises (e.g., following irrigation in the absence of proper drainage and/or application of excess water), the salty groundwater may reach the upper soil layers and, thus, supply salts to the root zone. Most crops do not grow well on soils that contain salts.

A key principle to minimize erosion is to maintain a cover of growing plants or organic and/or non-organic residues that protects surface soil. Some measures such as no-till/ reduced tillage both protect the surface and reduce runoff, whereas others such as terrace construction are more focused on runoff reduction. Measures such as mulching, minimum tillage, no-till by direct seeding, cover crops, agroecological approaches, controlled vehicle traffic, continuous plant cover and crop rotation, strip cropping, agroforestry, shelterbelts, and appropriate stocking rates and grazing intensities are also considered relevant to reduce erosion.

Actions to reduce runoff velocity and depth typically involve placing a physical barrier across the slope. Terraces are the best known of these physical measures, but procedures such as strip cropping, contour planting, agroforestry, grassed waterways and vegetative buffer strips can also be effective.

Salinization is reducing the world's irrigated area by 1-2 percent every year, hitting hardest in the arid and semi-arid regions.

Mitigation

Proper irrigation management and adequate drainage are essential for the prevention of salinization. Additionally, irrigation water quality is relevant. The suitability of water for irrigation depends on the amount and the type of salt the irrigation water contains. The higher the salt concentration of the irrigation water, the greater the risk of salinization. Sustainable irrigation and drainage management is, therefore, an issue that must be addressed at once.

How does ProTerra Foundation tackle this issue?

A significant percentage of the food we eat comes from the soil. **Therefore, soil erosion and salinization pose a major threat to global food security** and to the achievement of the Sustainable Development Goals (SDGs), as FAO indicates. Both are critical for protecting soil while ensuring a sustainable and food secure world and improving living conditions in places where it occurs.

"No one is really certain of the figures, but it seems that at least 8 percent of the world's irrigated land is affected," says FAO water expert Julián Martínez Beltrán. "In the arid and semi-arid regions, it's somewhere around 25 percent."

Salinization could be threatening up to 10 percent of the global grain harvest.

ProTerra Foundation believes that one of the biggest challenges of agriculture today relates to building up, maintaining and preserving the fertility of different soil types around the world.

ProTerra Standard establishes a set of core requirements to tackle soil degradation, related to:

- **Adoption of good agricultural practices to reduce the negative impact of agricultural activity on the soil;**
- **Encouragement to utilise crop succession and rotation, organic farming, tillage, and mulching;**
- **Conservation of water quality and quantity that directly relates to the potential risk of salinization.**

Sustainable agriculture practices must be urgently implemented to conserve soil quantity and quality.

Sources

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