Soil Quality Information Sheet

Soil Quality Resource Concerns: Salinization

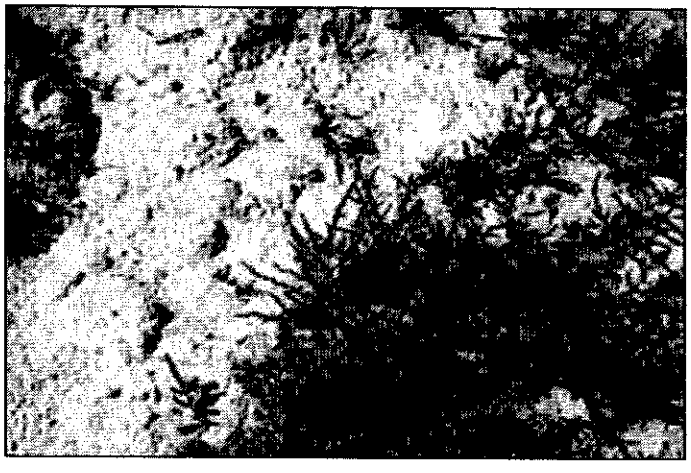
USDA Natural Resources Conservation Service January 1998

What is salinization?

Salinization is the process by which water-soluble salts accumulate in the soil. Salinization is a resource concern because excess salts hinder the growth of crops by limiting their ability to take up water. Salinization may occur naturally or because of conditions resulting from management practices.

Any process that affects the soil-water balance may affect the movement and accumulation of salts in the soil. These processes include:

- hydrology
- climate
- irrigation
- drainage
- plant cover and rooting characteristics
- farming practices



What causes salinization?

Salinization on the soil surface occurs where the following conditions occur together:

- the presence of soluble salts, such as sulfates of sodium, calcium, and magnesium in the soil
- a high water table
- a high rate of evaporation
- low annual rainfall

In semiarid areas, salinization often occurs on the rims of depressions and edges of drainageways, at the base of hillslopes, and in flat, low-lying areas surrounding sloughs and shallow bodies of water. These areas receive additional water from below the surface, which evaporates, and the salts are left behind on the soil surface.

Summer fallow management practices may cause increased salinization by increasing the soil moisture content to the point that water moves to seeps on hillslopes. Salts accumulate as the water evaporates from these seeps.

What are some indicators of soil salinity?

Early signs:

- increased soil wetness in semiarid and arid areas to the point that the soil does not support equipment
- the growth of salt-tolerant weeds
- irregular patterns of crop growth and lack of plant vigor

Advanced signs:

- white crusting on the surface
- a broken ring pattern of salts adjacent to a body of water
- white spots and streaks in the soil, even where no surface crusting is visible
- the presence of naturally growing, salt-tolerant vegetation

Soil salinity can be estimated by measuring the electrical conductivity of the soil solution. Electrical conductivity increases in a solution in direct proportion to the total concentration of dissolved salts.

What are some effects of salinization?

Salts in the soil increase the efforts by plant roots to take in water. High levels of salt in the soil have a similar effect as droughtiness by making water less available for uptake by plant roots.

Few plants grow well on saline soils; therefore, salinization often restricts options for cropping in a given land area.

Salinization degrades the quality of shallow ground water and surface water resources, such as ponds, sloughs, and dugouts.

How can salinity problems be managed?

Reducing the severity and extent of soil salinity is primarily a problem of water management. Water management can be addressed in two ways: (1) by managing the area contributing excess water to the soil (recharge area) or (2) by managing the area where the excess water comes to the surface (discharge area).

Recharge management:

- Decrease excess water from infiltrating into the soil in recharge areas of seeps by diverting surface water to downslope ponds.
- Maintain the water table at a low, safe level. Do not over irrigate. In some areas, over irrigation and the lack of natural drainage has raised the water tables, which may require the use of an artificial drainage system. Discharge of salty waters from these drains may contribute to other offsite problems.
- Irrigate to maintain salts at a level below the root zone in the soil.
- Use cropping and tillage systems that promote adequate infiltration and permeability. This includes building organic matter for soil aggregation and avoiding compaction.
- Plant crops that use the available soil moisture. Shallow-rooted crops may not extract excess subsoil moisture that can lead to salinity.
- Remove excess water from recharge areas of seeps by using actively growing, deep-rooted plants. Perennial plants and forages, especially alfalfa, are useful for this purpose because they have a longer growing season and take up more water from a greater depth in the soil than annual plants. Forages may also increase organic matter in the soil and improve soil structure.
- Return manure and crop residue to the soil to increase soil-water retention.
- Reduce summer fallow by continuous cropping.
- Manage snow so that it is evenly distributed and does not pond on thawing.

Discharge management:

- Grow salt-tolerant crops.
- Convert to permanent soil cover with salt-tolerant crops in high risk areas.
- Reduce deep tillage, which may bring up salts from deeper soil horizons.
- Plant forage crops or trees next to bodies of water to increase water use.
- Install artificial drainage systems in severely affected areas only.
- Eliminate seepage from irrigation canals, dugouts, and ponds.

Generally, control measures should take an integrated approach involving cropping, structural methods, and tillage systems.

(Prepared by the National Soil Survey Center in cooperation with the Soil Quality Institute, NRCS, USDA, and the National Soil Tilth Laboratory, Agricultural Research Service, USDA).

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