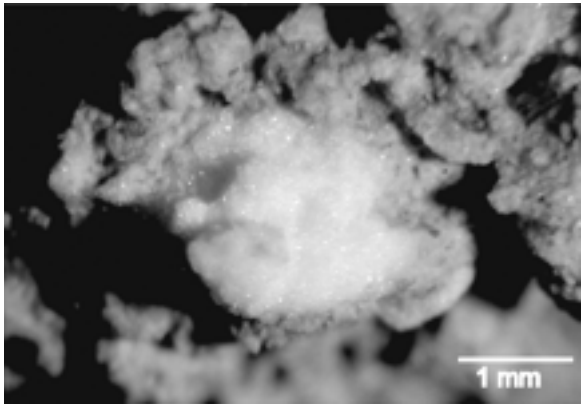
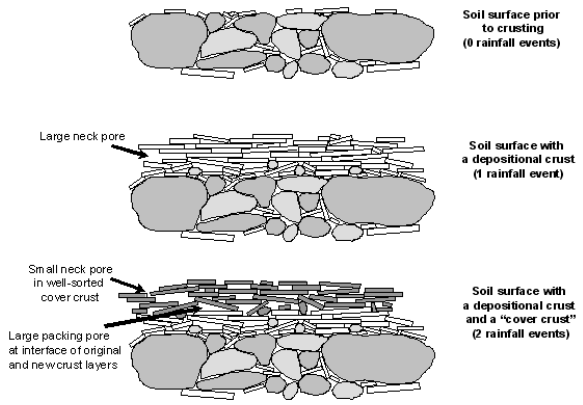
Planting in Saline Soil

Causes of Salinity in Desert Soils

- Too little rain to dilute salts in ground water
- Too much evaporation
- Too little rain to wash away surface salts
- Local irrigation water may have high salts





Action of Excess Salts in Soil at:

- Saline soils results from excessive concentrations of soluble salts and/or of exchangeable sodium
- Salts in Soil Water
- Salts in Colloid Particles

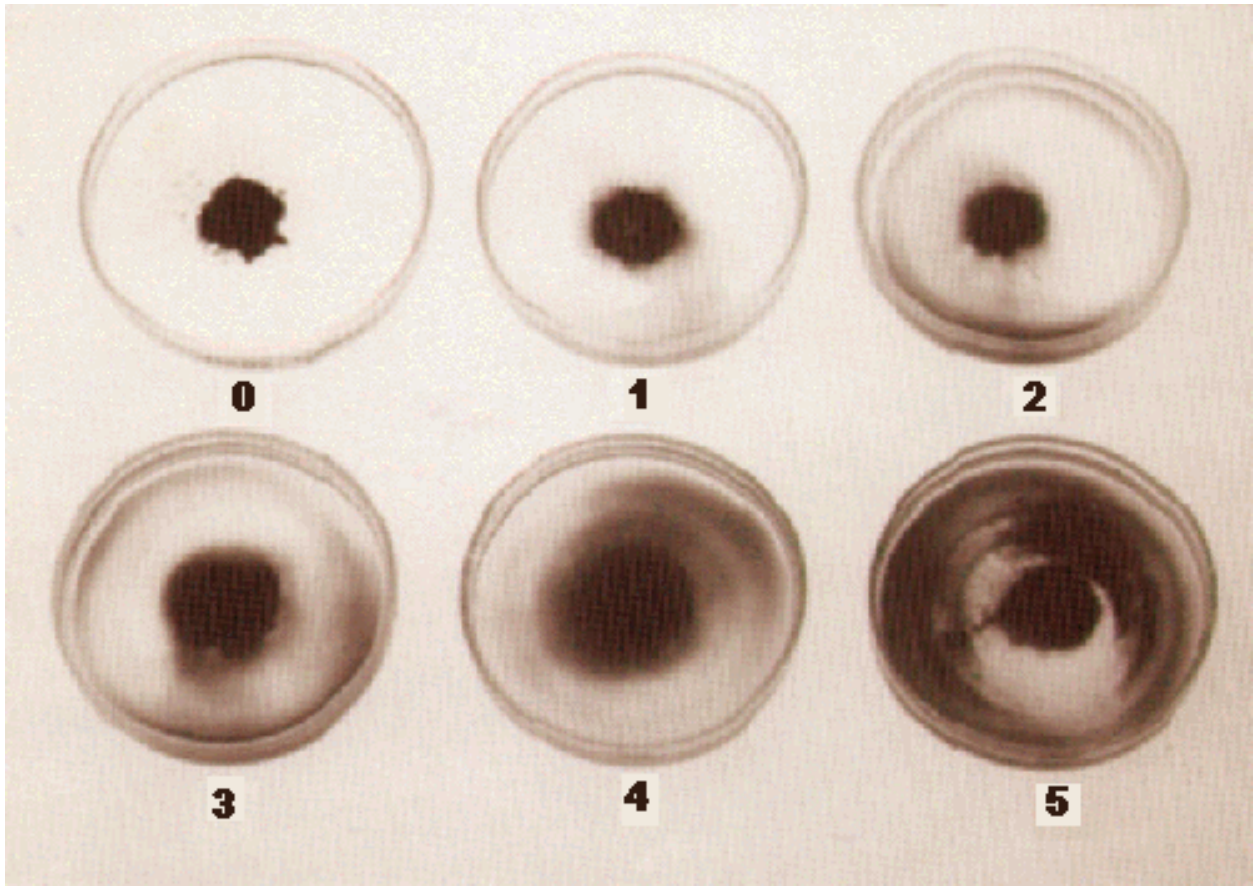
Salts in Soil Water

- The margins of areas of wetted soil without enough water become very saline.
- It is measured by its electrical conductivity (EC) in millimhos per cm or parts per million at 25 c^{o}. (ppm=mmhos x 640)Excess of the least soluble salt (sodium) cement soil causing surface crusting, acceleration of runoff and subsurface panning
- Excess of soluble salts makes soil unavailable for plants and it is toxic in concentration

Salts on Colloid Particles

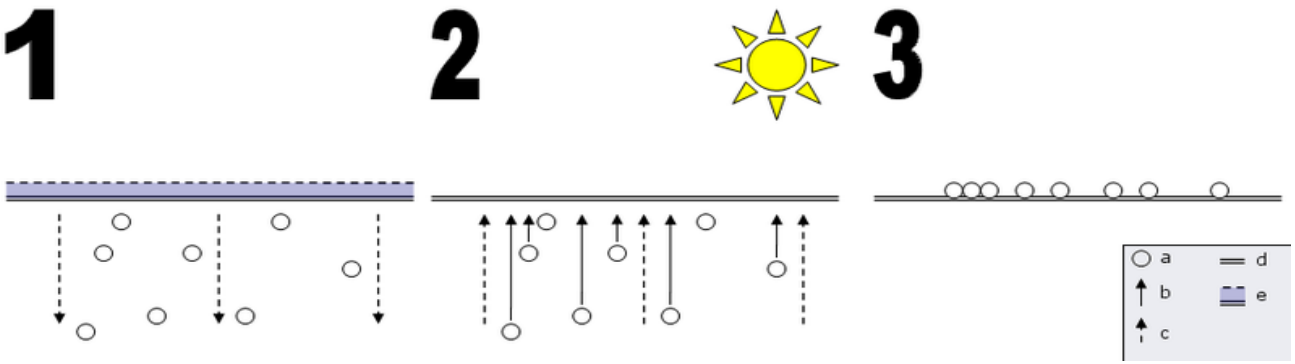
- Alkaline soils have too much sodium because of the adsorbation of calcium and sodium ions to the surface of colloid particles by electro-static attraction (measured as exchangeable sodium percentage)
- Sodium ions results in soil with a high swelling pressure resulting in low porosity and lower soil water and aeration.

- High percentage of sodium results in soil swelling. This effect is reversible.
- Low percentage of sodium results in the dispersion of clay particles (deflocculation) causing hard pans and surface crusting, which is irreversible.
- Soil alkalinity raises the pH, making iron unavailable to plants and causing panning.


0
1
2
3
4
5

Use of Irrigation Water

The Soil salt balance is dependant on the quality and quantity of irrigation water; their effect on the soil chemistry and structure; and the effect of these on plants.



- If using TSE (Treated Sewage Effluent), analyze the chemical quality, bacterial count, in addition to sediment content and soil drainage to determine the amount of water needed to leach salts bellow root level (Leaching Fraction)

- Salt concentrations at root zone can be leached with a leaching fraction of >20%
- if salt water is the only option, it can be used with a 50-60% leaching fraction if drainage is good (6-8 mmhos).

- Limit use of TSE in public and semi public areas.

Action of Salt on Plants

- Water Stress: Absorption difficulty
- Ion Stress Toxicity: excess of Na, Mg, Cl, or Boron.
- Nutrient Deficiency: Na, Cl, $MgSO_4$ ions inhibit the uptake of K, NO_3, HPO_4
- High Alkalinity: reduces uptake of many nutrients such as Fe.
- Reduced Hydraulic Conductivity: less watr and air in soil
- Panning: improper growth of roots and drainage.

Symptoms of Salinity in Plants

- Symptoms differ with species, stages of growth, distribution of salts in the soil and in individual plants.
- Symptoms are worst in hot dry environments

- Leaves stunted, thicker, darker
- Leaf tips then margins scorch and curl
- Salt burn in spots (Na), on leaf surface (Cl), turns yellow or brown, then wrinkle and wither.
- Leaves wilt, stem drops
- Leaves shed, stem dies

Management of Salt-Affected Soils

- Prevent salt accumulation
- Leach salt from root zone
- Improve drainage
- Use chemicals, fertilizers, organic conditioners
- Separate top soil from subsoil with membrane or gravel
- Use raised planters or containers
- Use salt tolerant plants
- Replace soil
- Use decorative mulch instead

Soil Treatment

- Leaching of Saline Soil
- Treatment of Sodic Soil
- Poor Drainage and Hardpan
- High Water Table
- Soil Amelioration (improvement)
- Salt-Tolerant Plants

Leaching of Saline Soil

- Leaching Factor (LF) = Depth of water leached below root zone/Depth of water applied at the surface

- A high leaching fraction (LF = 0.5) results in less salt accumulation than a lower leaching fraction (LF = 0.1).

Treatment of Sodic Soil

The common treatment for sodic soils improvement is to apply **calcium ions** in the form of **gypsum** (calcium sulfate, 22.5% calcium). to leach and soluble salts.

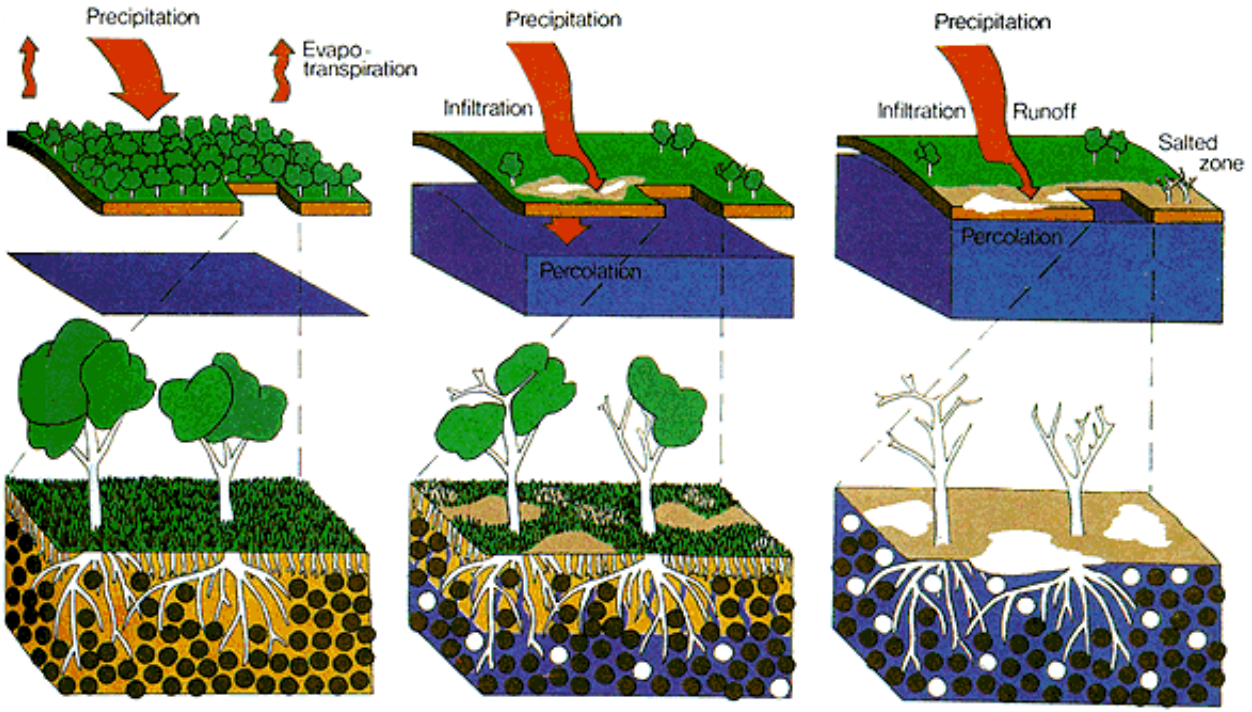
Application of **compost and earthworm** management improved the soil nutrient level and crops in reclaimed sodic soils.

Poor Drainage

- If land is Small
  - working in lots of organic matter
  - build raised beds on top of the wet ground fill them with a fertile, well-drained soil mix; and plant in them
  - excavate the soil and install underground drainage tiles or plastic pipes.
- If Land is Large
  - Plant water loving plants
  - create a pond, bog, or water garden in your wet area

High Water Table

Figure 9: Soil salinity - mainly caused by a rising water table



Before clearing
Most water is used where it falls. The system is in balance.

After clearing
Saline groundwater rises and is concentrated at the surface by evaporation. Vegetation growth is affected.

Later
Accumulation of salt at the surface kills protective plant cover. The land is open to erosion.

(Source: Dept. of Conservation, Forests and Lands, 1987)

Hardpan

- Mechanical method
  - In these situations, the hardpan can be broken up by either mechanical means such as digging or plowing
- use of soil amendments
  - increasing the amount of soil organic matter through the working-in of manure, compost or peat can improve local drainage and promote the proliferation of earth worms that can, over time, break relatively thin hardpan layers

Salt-Tolerant Plants