



# Extension Extra

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COLLEGE OF AGRICULTURE & BIOLOGICAL SCIENCES / SOUTH DAKOTA STATE UNIVERSITY / USDA

## What Causes Salinity in Dams and Dugouts?

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### What is the source of salts?

As minerals, rocks, and soils weather, many simple salts dissolve into the weathering water, with the actual salts produced dependent on the make-up of the minerals, rocks, and soils.

The dominant ions are sodium ( $\text{Na}^+$ ), calcium ( $\text{Ca}^{++}$ ) and magnesium ( $\text{Mg}^{++}$ ), chlorides ( $\text{Cl}^+$ ), sulfates ( $\text{SO}_4^{++}$ ), carbonates ( $\text{CO}_3^{++}$ ), and bi-carbonates ( $\text{HCO}_3^{++}$ ), although others are also present.

Another natural source of salts is the ancient salts deposited in pores and cracks of certain rocks and minerals. The Pierre shales of western South Dakota were formed by prehistoric deposition of sediment from an ancient ocean. During this process many ocean salts were trapped.

Under arid to semi-arid conditions, irrigation water can be a major source of salts. As plants roots extract water from the soil, most dissolved salts are left behind and accumulate, unless a portion of the soil water leaches below the root zone and carries dissolved salts with it.

Applications of fertilizers, both commercial and manure, add salts to soils. However, fertilizer applications that are based on crop needs typically

contribute insignificant amounts of salt. Similarly, manure left by livestock during grazing contributes insignificant amounts of salt.

### Why do salts accumulate in dugouts and dams?

Many western South Dakota soils were produced from rocks and minerals containing relatively high amounts of salts. As water leaches down through soil and underlying geologic material, the water dissolves these salts as well as a very small amount of rock and minerals.

When drainage water moves downward, it often reaches an impermeable layer and is stored or moves laterally. Springs and seep areas develop in fields and on sloping landscapes when drainage water discharges to the land surface and produces a wet area or flows to a waterway or stream.

During hot, dry conditions, seep and spring water is lost by evaporation. Dissolved salts left behind on the land surface and in the soil profile often look like white powder. These salt accumulations are called alkali spots.

During snowmelt and large rainfalls, runoff water dissolves some of the salts on the land surface, especially where seep or spring areas are present.

These dissolved salts then are transported by the runoff to streams or to dams and dugouts that intercept and store it.

### **Why does salinity increase during drought?**

During extended drought periods lasting months, little runoff occurs to dilute dissolved salts already present in dams and dugouts. In addition, high evaporation rates (up to half an inch per day on 100-degree-plus, windy, low humidity days) concentrate the salts in smaller volumes of water.

Consequently, as the water level declines, the concentration of salts—the salinity— increases. The high salinity levels will persist until runoff refills the dam or dugout. Periodic overflow prevents

long-term buildup of salts. Occasional cleanout of dams and dugouts to remove sediment buildup also removes accumulated salts.

### **Why do toxic levels of selenium only occur periodically and/or in selected dams and dugouts?**

Certain geologic formations, especially Pierre shales, contain naturally high levels of selenium (Se) as well as high overall salt load. Discharges of water by seep areas and springs from these geologic formations sometimes contain toxic selenium concentrations.

Just as with any dissolved salt, Se is concentrated during drought periods when water levels drop due to high evaporation and lack of runoff.

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